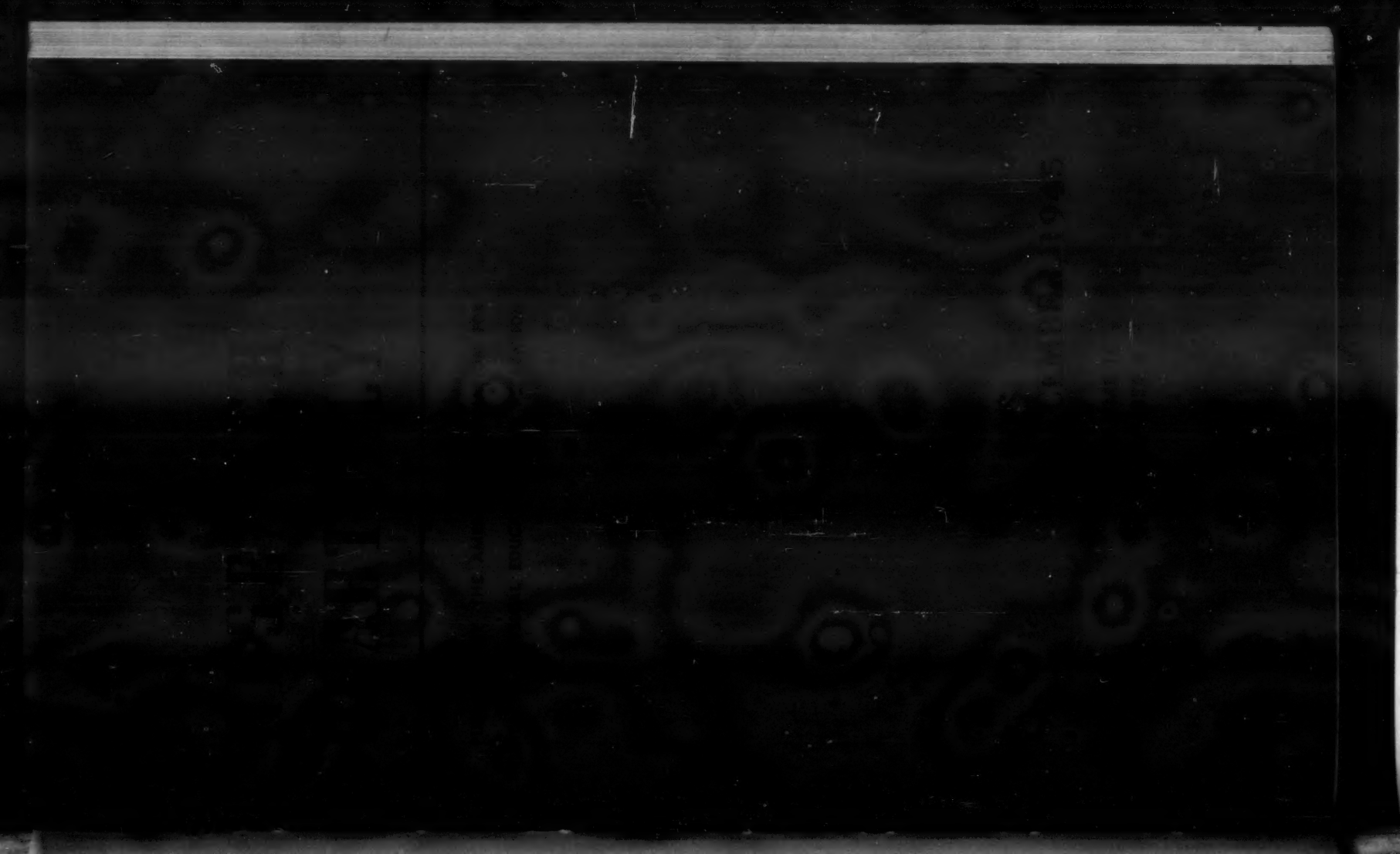

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A Study of Improvement in Fitness of College Freshmen Women

By Helen M. Petroskey
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INTRODUCTION

FOR the past two years all physically sound freshmen women at the University of Oregon have been required to take a course in basic physical education sometime during the freshmen year. The organization of such a course was based on the assumption that there were certain important physical education materials and experiences from which all students could benefit, and that these materials could be more effectively presented when organized as a separate course and directed toward certain specific objectives.

The course was designed to contribute to certain aspects of the physical well being of the women students. Areas in which outcomes were sought were:

1. Motor fitness which included such factors as strength, especially of arms, feet, legs, and abdominal muscles; agility, flexibility, and basic skills such as throwing, jumping, and running.
2. Functional or dynamic fitness[1] or endurance involving circulatory-respiratory adjustment to strenuous activity.
3. Body mechanics or good body balance in standing, walking, running, and sitting, and proper use of the feet.
4. Knowledge and techniques for relaxation and amelioration of menstrual cramps.

This study has for its purpose the investigation of the amount of improvement achieved in the areas of motor and dynamic fitness by freshmen women students taking Basic physical education for one term.

SUBJECTS

The scores of 284 freshmen women students at the University of Oregon, registered in Basic physical education for the fall term, 1944-45, were used in this study. These students had been declared physically sound by the Student Health Service and were registered in their first term of college physical education. Many of the students had had no physical education training since their sophomore

[1]The term "dynamic fitness" is used throughout this article in the same sense as defined by Brouha, Fradd, tnd Savage in "Studies in Physical Efficiency of College Students," *Research Quarterly*, 15:3 (Oct., 1944).

year in high school, and with the exception of a few who had worked at jobs involving strenuous physical labor during the summer, they could not be considered in a "well conditioned" physical state.

THE COURSE

Out of the official eleven weeks' term, the actual length of the activity period in physical education was ten weeks. Classes met for three thirty-five minute activity periods each week. Approximately the first two weeks in the term were spent in orienting the students to the course and in teaching them the test techniques. It had been found from previous experience that test results were more satisfactory when students had had time in which to learn the techniques involved.

Activities used in the course consisted of (1) exercises for increasing flexibility, strength, and correction of postural and feet defects; (2) apparatus work involving jumping, vaulting, landing, climbing, and supporting the weight with the arms; (3) tumbling stunts; (4) relays; (5) endurance running. Although considerable time was spent in presenting material related to the objectives in body mechanics and knowledge, the major portion of the class time in each period was devoted to the activities mentioned.

The Basic physical education sections were taught by four instructors, each following the same schedule for giving tests and ratings, but each responsible for selecting the material she thought would best meet the objectives of the course. All but one of the instructors had had a year's experience in teaching the course. The use of an instructor's manual, developed by the writer, in addition to occasional meetings of the Basic instructors, helped to establish a certain uniformity in selection of material and class procedures.

A student laboratory manual, prepared by the writer, was used by the students throughout the course. The manual was designed to provide the students with some concept of the nature of the course, to make it possible for them to retain and compare their own test and rating scores, to motivate their interest in achieving for themselves the purposes of the course, and to furnish certain informational background material for much of the work to be undertaken.

Classes averaged approximately forty students in each section.

TESTING PROCEDURE

A battery of eight motor fitness and one dynamic fitness test was administered at the beginning and end of the Basic term. The tests[2] were: modified pull-up, jump and reach, squat-thrust for 30 seconds, basketball distance throw, potato race, modified pushup, standing

[2]The tests were taken by the students in the order mentioned.

broad jump, sit-up, and the Brouha step test of dynamic fitness.[3] The first testing period was held at the end of the second week of class activity and the second administration of the tests was given seven weeks later. The Brouha step test was given during the preceding class period in each Basic section under the supervision of the individual instructors.

The other eight tests were administered to all students in Basic in a special testing period by the women's physical education staff, assisted by physical education major students. Most of the instructors had had experience in giving these tests, and all student assistants had taken the tests themselves and had had some instruction in giving the tests. Each tester was given the responsibility of administering the same test throughout the testing period. With few exceptions, the same personnel administered the tests at the end of the term under the same organization. The students took all eight tests during one period, following a prescribed order which spaced the more strenuous tests among the less strenuous ones.

Modified Pull-up.—For this test, a wooden bar was placed across the back of two straight chairs. The bar was held firm by students sitting in the chairs. Those taking the test were given the following directions: "Sit down directly under the bar. Reach up and grasp the bar with palms facing you and arms shoulder distance apart. Push the feet as far forward as you can and still keep the whole foot flat on the floor. (This made an angle at the knee, when the hips were lifted, between eighty and ninety degrees.) Lift the hips from the floor. Keep the body in a straight line and pull up to touch the top of the chest bone to the bar. Do this as many times as you can without stopping, fully extending the arms each time, keeping the body straight and touching the top of the chest." After the starting position was once taken and considered satisfactory by the test administrator, the student was not allowed to shift the position of the feet, change the grasp, arch the back, or touch any part of the chest except the portion of the chest bone just below the chin. The score was the number of pull-ups done in succession. Reliabilities on this test range from .921 to .963.

Jump and Reach.—A board frame with graduated wooden strips attached was used for this test. Each strip was numbered and each was one inch shorter than the preceding one. The student stood directly under the strips and moved until she could reach with one hand the shortest strip possible and still keep both feet flat on the

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3For a description of this test refer to the following: Lucien Brouha, "The Step Test: A Simple Method of Measuring Physical Fitness for Muscular Work in Young Men," *Research Quarterly*, 14:1 (March, 1943); Harriet L. Clarke, "A Functional Physical Fitness Test for College Women," *Journal of Health and Physical Education*, 14:7 (September, 1943).

floor. The number of this strip was recorded. The student then was urged to jump and reach the shortest strip she could reach, using a standing jump. Any number of trials was permitted. The number of the shortest strip touched was recorded and the difference between this and the first one touched was the student's score. Reliabilities ranged from .932 to .974.[4]

Squat-Thrust for Thirty Seconds.—The Burpee technique was used. Standard procedure was used in this test with the student making four distinct movements for each cycle. The score was the number of complete squat-thrusts plus the number of the movement the student was in when stopped at the end of thirty seconds. Reliabilities for this test ranged from .704 to .968.

Potato Race.—Two lines, thirty feet apart, were drawn on the gymnasium floor with the student standing behind one line and two blocks of wood behind the other. At the signal, "go," the student ran, picked up one block of wood and placed it behind the starting line, ran and recovered the second block of wood, and returned with it at full speed across the starting line. Two trials were given and the better time taken as the score. Two timers, one giving the starting signal, conducted this test with two students running at a time. This provided a certain competitive element which stimulated better performance on this test. This test had a reliability of .70.

Basketball Distance Throw.—Official basketballs were used. The student stood behind a restraining line and was given three trials to throw the ball as far as she could using a single arm throw. The floor in front of the restraining line was marked off, beginning at twenty-five feet, by parallel lines five feet apart. The place where the ball landed was marked by the tester and the distance thrown estimated to the nearest foot. Score was the farthest throw made in three trials. Reliability of this test was .890.

Modified Push-up.—This test was done on a mat. The student took a prone lying position, separated the legs slightly, and bent the knees. At the same time, she placed her hands flat on the mat in such a position that her thumbs were outside of and touching the shoulders. From this position, and while keeping the trunk straight from shoulder to knees, a push-up to a straight arm position was made. In preparation for each push-up, the body was lowered to the mat far

[4]Reliabilities for the pull-up, sit-up, jump and reach, squat-thrust and push-up, administered according to the same techniques used in this study, were obtained by Mildred Thomas, Utah State College, on a group of approximately 100 college women registered in swimming, body conditioning, and dance at the University of Oregon and Utah State College. The tests were repeated within a period of two days and were administered by her. Reliabilities for the potato race, standing broad jump, and basketball throw were obtained on 160 University of Oregon women students in Basic during the fall term of 1943-44. The tests were repeated after one week and were administered by student squad leaders under the writer's supervision. Higher reliabilities could undoubtedly be obtained with the testing procedure used in this study.

enough to permit the chin only to touch. The subject was not allowed to touch the waist to the mat, to bend at the hips, to change the position of the hands, or to stop the rhythm of the movement. Score was the number of correctly done push-ups. Reliabilities on this test ranged from .926 to .955.

Sit-up.—The subject started from a lying position on a mat with hands clasped behind the neck and a partner holding her feet. She raised her trunk and sat up far enough to touch the elbows to the knees. The subject was not allowed to unclasp her hands, change the rhythm of the movement, or fail to touch the knees. The subject was permitted to bend the knees slightly on the "sit-up." Score was the number of sit-ups done without stopping. Range of reliabilities for this test was from .941 to .988.

Standing Broad Jump.—This test was done according to standard procedures on painted, hard surface mats. The distance in feet and inches was marked on the mats. Three trials were allowed, and the score was the longest jump in the three trials measured to the nearest inch. Reliability of this test was .88.

The Brouha Step Test of dynamic fitness was modified slightly in order to make it possible to use student observers and utilize the equipment available. The students were trained in counting each other's carotid and radial pulse. A fifteen-inch stool was used. The students worked in pairs, one taking the test and the other sitting behind her as the observer. The instructor beat out the rhythm of the step-up on a drum, called out the thirty-second time intervals, and gave the signals for the three pulse-counting periods. Observers were responsible for checking on form, loss of rhythm, and the time when their subject sat down, in case of inability to complete the full four-minute test. The students were given one short practice trial on the test during the class period before the final test was given. During the pulse-counting periods, both the observer and the subject counted the pulse at the carotid artery and both counts were recorded. This provided a check on the accuracy of the pulse count.

The range of scores (25 to 110), the fact that from twenty-six to thirty per cent of the students failed to complete the first test, and the appearance of near exhaustion on the part of the students completing the test, would indicate that the fifteen-inch stool, instead of the sixteen-inch recommended for high school girls, or the eighteen-inch stool for college women, had not greatly impaired the useful range of strenuousness of the test.

RESULTS

Table I presents the beginning and end of the term mean fitness scores for 284 freshmen women along with the standard deviations, differences in means, the standard deviations of these differences, and the significance ratios.

TABLE I

BEGINNING AND END OF THE TERM MEAN FITNESS TEST SCORES FOR 284 FRESHMEN WOMEN WITH STANDARD DEVIATIONS, DIFFERENCES IN MEANS, AND SIGNIFICANCE RATIOS

Test	First Mean	Test S.D.	Second Mean	Test S.D.	Difference in Mean	σ_{m_1}	σ_{m_2}	Significance Ratio
Sit-up	19.93	10.53	32.25	12.48	12.32	.306		40.26
Squat-Thrust	11.75	1.90	13.26	1.75	1.51	.152		9.90
Pull-up	5.48	3.98	8.72	4.56	2.88	.359		8.02
Basketball Throw	43.01	7.98	45.96	8.20	2.19	.215		10.18
St. Broad Jump	5'2.19"	6.81	5'3.28"	6.96	1.09"	.183		5.95
Jump & Reach	13.02	1.95	13.24	1.99	0.22	.153		1.40
Push-up	10.68	6.71	15.58	7.01	4.90	.575		8.52
Potato Race	11.07	.77	11.29	.73	0.22	.16		1.37
Step Test	62.06	18.12	66.14	10.95	4.08	1.44		3.56

Women students in Basic physical education, during a seven-week period made gains in their ability to perform all tests except the potato race. These gains were likewise statistically significant in all abilities except the standing broad jump. The small loss indicated in the potato race was not significant.

One might interpret these findings as indicating that one term of Basic physical education makes a contribution to increased abdominal and arm strength, muscular and circulatory-respiratory endurance, and the ability to coordinate strength and skill in throwing. Its contribution to leg power and strength is negligible. This is probably due to the fact that the innate contraction speed of muscle places definite limitations on the amount of improvement which could be expected in the jumping abilities unless improvement in actual leg strength had been great. The same factor, also, places limitations on the possibilities of making significant gains in speed events.

Table II shows the per cent of students who improved, lost, or remained the same, with the average points gained and lost in the nine motor and dynamic fitness tests after participating in seven weeks of activity in Basic physical education.

The greatest number of students improved in ability to do the sit-up. Ninety-eight per cent of the students made an average improvement of twelve points in this test, no students declined in this ability, and only two per cent failed to improve their scores. Practice in this test seems to yield more encouraging results than most of the other tests used in this group. The importance of abdominal strength was emphasized throughout the course, and the sit-up test was used frequently in class instruction as an exercise for increasing abdominal strength.

In the ability to do the push-up, ninety per cent of the students

TABLE II

PER CENT OF STUDENTS WHO IMPROVED, LOST, OR REMAINED THE SAME WITH AVERAGE POINTS GAINED AND LOST IN MOTOR AND DYNAMIC FITNESS AFTER ONE TERM OF BASIC PHYSICAL EDUCATION

Test	Improved	Average Gain	Lost	Average Loss	Same
Sit-up	98%	12	0%	0	2%
Squat-Thrust	82%	2	13%	1.2	5%
Pull-up	78%	4.5	12%	2.5	10%
Basketball Throw	71%	6 ft.	21%	3 ft.	8%
St. Broad Jump	66%	4 in.	21%	3 in.	13%
Jump & Reach	54%	1.6	17%	1.3	19%
Push-up	90%	6	7%	3	3%
Potato Race	57%	.6 sec.	26%	.5 sec.	17%
Step Test	60%	9.5	29%	5.9	11%

improved an average of six push-ups as against seven per cent who lost an average of three push-ups and three per cent who remained the same. This test was also frequently practiced in class as an exercise for strengthening the arm extensors.

The thirty-second squat-thrust ranks next in order of per cent of students improving. Eighty-two per cent gained an average of two points in this ability, thirteen per cent lost an average of one point, and five per cent remained the same. Gain in this ability is probably due as much to a mastery of the technique of the test, which many girls found complicated and difficult, as to a gain in muscular endurance or general agility.

In the pull-up, seventy-eight per cent improved an average of four points, while twelve per cent lost an average of three points and ten per cent remained the same.

A high percentage of students gaining in ability is again shown in the basketball distance throw. Seventy-one per cent gained an average of approximately six feet, only eight per cent remained the same, while approximately one-fifth of the students lost an average of three feet.

Gains by more than half of the students were also made in the standing broad jump, potato race, and jump and reach. The average gain in all these abilities is small. In these abilities, also, approximately one-fifth of the students lost an average number of points only slightly less than the average gain. The low reliability and slight average loss in the potato race make any apparent gains in this ability of little significance.

More students lost in the Brouha step test than in any other ability, although the actual average loss in index points is only six. The sixty per cent who gained in this ability, however, earned an average of nine and a half points. This would seem to indicate a real gain in dynamic fitness on the part of those who gained. Further

analysis (Table III) shows that these were largely students who earned low scores in this test at the beginning of the term.

In order to obtain a clearer picture of changes in abilities of students at different fitness levels, changes between initial and final test scores were tabulated according to scores earned on the initial test. Three fitness or ability groups were recognized, the low, medium, and high. The medium group consisted, roughly, of all those whose scores fell within one sigma distance on either side of the mean; the high and low groups were those with scores above and below one sigma distance, respectively.

Table III gives the per cent of students who gained, lost, and remained the same in each of these fitness groups.

TABLE III

PER CENT OF STUDENTS WHO GAINED, LOST, AND REMAINED THE SAME IN LOW, MEDIUM, AND HIGH FITNESS GROUPS AFTER ONE TERM OF BASIC PHYSICAL EDUCATION

	Low Goup			*Medium Group*			*High Group*		
Test	*Gained*	*Lost*	*Same*	*Gained*	*Lost*	*Same*	*Gained*	*Lost*	*Same*
Sit-up	93%	0%	7%	98%	.0%	2%	100%	0%	0%
Squat-Thrust	94%	6%	0%	85%	9%	6%	56%	39%	5%
Pull-up	87%	0%	13%	70%	12%	8%	63%	27%	10%
Basketball Throw	78%	18%	4%	74%	18%	9%	61%	32%	7%
St. Broad Jump	79%	15%	6%	64%	22%	14%	63%	25%	13%
Jump & Reach	60%	10%	30%	56%	14%	30%	34%	41%	25%
Push-up	93%	5%	2%	92%	5%	3%	78%	13%	9%
Potato Race	78%	17%	5%	51%	28%	21%	24%	43%	33%
Step Test	92%	4%	4%	59%	29%	12%	29%	63%	8%

With the exception of the sit-up, the greatest per cent of students making gains in all tests was found among the students with low initial scores. Students of medium ability were next in number of students making gains, with still fewer students in the high group making gains. The per cent of students gaining in sit-up ability is high in all groups, but strangely enough, the small per cent who made no gains were all in the low and medium groups.

The reverse is true when the per cent of students who lost in the three groups is considered. In all abilities except the sit-up, a higher per cent of students in the high group lost in ability than in any other group. Also, in the high group a greater per cent of students lost than gained in the jump and reach, potato race, and the Brouha step test. The high per cent of students who lost is particularly marked in the step test in which sixty-three per cent of the students with initial high scores lost in the second test. This stands in marked contrast to the ninety-two per cent who gained in the low group.

From this type of data analysis, it is apparent that a seven weeks'

term of Basic physical education does very little for many of the students who enter the course with a high degree of fitness. It apparently does stimulate, however, a fairly large percentage of students in the low and medium fitness groups to make some improvement. A longer period of activities, coming more frequently than three days a week, would probably result in gains for those in the high group along with increased gains by those in the medium- and low-ability groups.

CONCLUSIONS

1. This study seems to indicate that a high percentage of the University of Oregon freshmen women enrolled in one term of Basic physical education make significant gains in motor and dynamic fitness. Gains in ability to do the sit-up, modified push-up, thirty-second squat thrust, and modified pull-up are made by three-fourths or more of the students.

2. More than half of the Basic students made gains in ability to do the basketball throw, jump and reach, standing broad jump, potato race, and in circulatory-respiratory adjustment to strenuous activity as measured by the Brouha step test. The average gains in the jump and reach and potato race, however, are too small to be significant. The average gains made by the students in all abilities tested were greater than the average loss.

3. When students' scores were analyzed in terms of three ability groups on the basis of initial test scores, it was found, with the exception of the sit-up, that a greater per cent of students in the low group improved than in any other group. The medium-ability group showed the next highest per cent of students gaining in all activities. A lower per cent of students in the high-ability group showed gains on the second test than was true of any other group. Also, a larger per cent of students in this group lost in ability than was true of the other ability groups.

4. Of considerable significance is the contrast shown between the low- and high-ability groups in the Brouha step test. Ninety-two per cent of the students in the low group showed gains, while sixty-three per cent of the students in the high group lost in this aspect of fitness. This finding, along with the tendency of a higher percentage of the high fitness group to lose in ability, probably points to the conclusion that the activities selected and teaching methods employed in Basic physical education sections are geared to the abilities of the mediocre and low groups. Relatively large numbers of students in these groups are sufficiently stimulated to show gains in fitness, but far too great a portion of high-ability students either fail to gain or actually lose in fitness status during the term. This suggests the advisability of placing students into ability sections and accommodating both materials and teaching techniques to the fitness level of the students.

The Relation of Intelligence to the Learning of Fundamental Muscular Skills

By Louis E. Kulcinski
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STATEMENT OF THE PROBLEM

Selection *of the problem.*—Does any relationship exist between various degrees of intelligence of fifth- and sixth-grade boys and girls and the ability to learn selected fundamental muscular skills? Since the mind and body cannot function independently, and since skills are a part of coordination, it seemed interesting to know if such a relationship existed, and if so, could it be shown or measured.

The purpose of the study.—The primary purpose of this study is to determine, so far as possible, the effectiveness of superior, normal, and subnormal intelligence quotients of fifth- and sixth-grade boys and girls in learning selected fundamental muscular skills when the same material is presented. The major consideration is the degree of mastery of twenty-two tumbling exercises commonly used and considered fundamental muscular skills as determined from analysis of other sources and supported by a previous study.[1]

Definition of terms.—The test exercises were broken down into three component parts, or elements, as the logical divisions of the test exercises into the three general positions through which the body passes in performing the test exercise.

Requirements are the three objective standards for each test of both batteries which had to be met in order to successfully pass the test.

POP (preliminary objective performance) tests are a battery of ten simple test exercises used for the purpose of equalizing the groups in their skill ability, and used as a criterion to secure a raw score. The battery was given twice; once, as an initial test before training, called POP-1, and again as an end test after training and ten practices, called POP-2. The result of this battery of tests is the basis of all comparisons and measurements. The difference between

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This article is a summary abstract of a dessertation accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Michigan, October, 1943.

[1]Louis Kulcinski, "What is the Comparative Effectiveness of the Formal, Informal, and Combination Methods When Instructing University Freshmen in Fundamental Muscular Skills?," master's thesus, University of Illinois, Urbana, 1929.

the initial test score and end test score indicates the degree or amount of learning.

FOP (final objective performance) tests are a battery of twenty-two difficult test exercises with an initial and end test called FOP-1, and FOP-2; the differences between the results of these two tests indicates the degree of learning.

REVIEW OF LITERATURE

Studies directly related to the problem of intelligence and the learning of fundamental muscular skills.—As the survey of the literature was conducted for the historical sketch of tumbling, the question arose as to whether the tumbling and stunt type of activities as used throughout the ages would have practical value for experimental purposes. It was found that two such studies had been conducted, the results of which indicated the reliability of using such activities for practical experimental purposes. Both studies used twenty-two especially selected exercises, the same as those used for the final objective performance (FOP) battery in this study, and both studies identified them as fundamental muscular skills. One was a comparative study of teaching methods.[2] The other was an experimental study of the effect of grading upon learning fundamental muscular skills.[3] In both of these studies the subjects were college students.

Only one other study was found which contained most of the factors covered in this experiment.[4]

One other study was found which resembled the approach to this study and problem of the relationship of intelligence to learning, namely, learning to swim.[5]

The various studies reviewed indicate that there are varying degrees of correlation between intelligence and motor ability. The relation between achievement in physical education skills and intelligence is low; the correlations between intelligence and tumbling and stunt exercises are high.

The review of literature revealed that, in general, the studies dealing with motor skills had been conducted under artificial conditions. In this study the groups were selected from school-run subjects. No special selections or eliminations were made, and the administration of the tests was done under regular classroom conditions with normal instructional procedures.

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[2]Louis Kulcinski, "Comparative Effectiveness of the Formal, Informal, and Combination Methods of Instructing University Freshmen in Fundamental Muscular Skills," *Research Quarterly*, 2:2 (May, 1931), p. 21.

[3]Oliver M. Langhorst, "An Experimental Study of the Use of Grading as an Incentive in the Performance of Certain Muscular Skills," unpublished master's thesis, University of Illinois, Urbana, 1934, p. 17.

[4]Cecille A. Meserve, "Status of Relationship of Motor Ability and Mental Ability," unpublished master's thesis, University of New Hampshire, Durham, 1933.

[5]Harold W. Copp, "Swimming as a Motor Skill," unpublished doctoral dissertation, University of Michigan, Ann Arbor, 1940, p. 62.

Source of data.—An ideal arrangement and convenient opportunity presented itself for the study of the relationship of intelligence to the learning of fundamental muscular skills. The superior and normal groups were the fifth and sixth grades of a Massachusetts state teachers college training school. The subnormal groups were a class of three-year retarded children. A total of a hundred and five subjects with intelligence quotients ranging from 123 to 45 for the boys, and from 125 to 41 for the girls was studied.

ANALYSIS AND DISCUSSION OF RELATIONSHIPS OF EXPERIMENTAL DATA

The Chi Square Test.—The Chi Square Test for chance or statistical significance was used for observed associations. If Chi Square is greater than four, then chance does not account for the observation. Only whole number correlations were considered. All fractional correlations were dropped to the lower integer. Group correlations were made between Groups I and II, and II and III, and I and III. Sex correlations were made between boys and girls. In tables the inverse relationships are indicated with asterisks.

(1) *Does any relationship exist between various degrees of intelligence of fifth- and sixth-grade boys and girls and the ability to learn fundamental muscular skills?*

Table I shows the correlations based upon the total number of exercises passed by the experimental groups and by sex in the various tests.

It should be noted that there are no figures for FOP-1, the initial test of the final objective performance battery, due to the fact that none of the subjects passed the three requirements for the test exercises.

TABLE I

CORRELATIONS BETWEEN EXPERIMENTAL GROUPS WITH I. Q., SEX, AND TESTS HELD CONSTANT FOR THE TOTAL NUMBER OF TEST EXERCISES PASSED

Tests		POP-1		POP-2		FOP-2	
Groups		*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*
I	Superior						
II	Normal	7	4	0	10	16	3
II	Normal						
III	Sub-normal	3	0	5	14	4	10
I	Superior						
III	Sub-normal	47	22	12	42	27	83

High positive relationships exist between I. Q. and the ability to perform fundamental muscular skills. The results for the experimental groups show the following observations: except for the boys

in the simple battery, after training, the superior groups are low but significantly higher than the normal groups; the normal groups are higher than the subnormal groups in a significant but not as marked a degree as for the superior groups over the normal groups; and the significance of the superior groups over the subnormal groups is much greater than that of the normal groups over the subnormal groups.

The results of the sample groups remain consistent with the significant, high positive conclusions shown in the results of the experimental groups confirming the positive results, namely, that a relationship exists between intelligence and the learning of fundamental muscular skills.

(2) *What is the degree of learning between various degrees of intelligence of fifth- and sixth-grade boys and girls and the ability to learn fundamental muscular skills?*

Table II shows the correlations based upon the total number of exercises learned by the experimental groups and by sex in the various tests.

The results of the experimental groups show the following conclusions:

1. The normal groups learn more than the superior groups in the simple battery.

2. The normal and superior groups have an equal advantage over the subnormal groups in learning exercises of the simple battery.

3. The normal and superior groups have a significent advantage over the subnormal groups in the difficult battery.

4. The superior groups have a slight advantage over the normal groups in the difficult battery.

The results of the sample group show that there is an inverse order of difference by a slight margin between the groups for the total number of elements learned in the simple battery. In the difficult battery, the superior and normal groups almost double the total number of elements learned by the subnormal groups. These results indicate that a relationship exists between intelligence and the degree of learning.

(3) *Is there any significant difference between sexes learning fundamental muscular skills?*

Table III shows the correlations between the sexes of the experimental groups for the total number of exercises passed and the net total number of exercises learned. None of the subjects passed any of the FOP-1 tests, the initial test of the final objective performance battery, which accounts for its omission. Since none of the subjects could pass FOP-1, the figures represented in the total number of exercises passed are duplicated in FOP as also representing the total number of exercises learned.

TABLE II

CORRELATIONS BETWEEN EXPERIMENTAL GROUPS WITH I. Q., SEX, AND TESTS HELD CONSTANT FOR NET TOTAL NUMBER OF EXERCISES LEARNED

Tests *Groups*		*POP* *Boys*	*POP* *Girls*	*FOP* *Boys*	*FOP* *Girls*
I	Superior				
II	Normal	0	0	5	2
II	Normal				
III	Sub-normal	11	3	10	54
I	Superior				
III	Sub-normal	0	4	12	63

The results shown in Table III are positive and indicate the conclusion that there is a significant difference between sexes in learning fundamental muscular skills.

TABLE III

CORRELATIONS BETWEEN SEXES OF EXPERIMENTAL GROUPS WITH I. Q., GROUPS, AND TESTS HELD CONSTANT FOR THE TOTAL NUMBER OF EXERCISES PASSED AND THE NET TOTAL NUMBER OF EXERCISES LEARNED

(Total exercises passed)

		Group I *Superior* *N-20 Boys* *N-20 Girls*	*Group II* *Normal* *N-20 Boys* *N-20 Girls*	*Group III* *Sub-normal* *N-14 Boys* *N-11 Girls*
POP-1	Boys			
	Girls	0	0	0
POP-2	Boys			
	Girls	7*	0	0
FOP-2	Boys			
	Girls	7*	11*	4
		(Net total exercises learned**)		
POP	Boys			
	Girls	4*	0	0
FOP	Boys			
	Girls	7*	11*	4*

* Indicates the relationship in inverse order.

** Duplication of figures 7, 11, and 4 under FOP-2 in total exercises passed and FOP in net total exercises learned are due to the fact that none of the subjects passed FOP-1 tests.

Girls are superior to boys in almost all items measured and compared. The results on the basis of total number of exercises passed show that:

1. There is no difference between the sexes in the simple battery before training.

2. A definite tendency favoring the girls in the superior group appears in the simple battery after training.

3. The girls are definitely superior to the boys in the difficult battery after training.

4. Except for the subnormal girls, the results are significant.

The significance is more pronounced and conclusive when considering the net total number of exercises learned. The superior girls have a significant advantage in the simple battery, while no apparent advantage exists in the normal or subnormal groups. In the difficult battery there is a definite positive superiority of the girls over the boys in the three groups of intelligence; the superior and normal girls have a higher significant difference than the subnormal girls; the significance of the superior girls is almost twice as great as that of the subnormal girls; and the significance of the normal girls is almost three times as great as that shown for the subnormal girls. The conclusions of the sample groups, based upon the total number of elements passed and the net total number of elements learned, confirm the results of the experiment groups: There is a positive and significant difference between fifth- and sixth-grade boys and girls in learning fundamental muscular skills, a difference favoring the girls; and with instruction, the girls learn better than the boys.

The final conclusion for this question of the problem is that the superiority of the girls over the boys is established and well marked and the learning of fundamental muscular skills is due to the effect of intelligence and training, and that the girls hold an advantage in seven of the eight significant comparisons.

(4) *Is there any significant difference between sexes in learning the more difficult test exercises?*

Table IV shows the relationships between boys and girls in the five easy and five hard exercises in the initial test before training and the end test, after training, of the POP (preliminary objective performance) battery and between the eleven easy and eleven hard exercises in the end test, after training, of the POP (final objective performance) battery. POP-1 is the initial test, and POP-2 and FOP-2 are the end tests. There are no correlations for FOP-1, the initial test of the final objective performance battery, as none of the subjects passed any of the exercises. The correlations are given for boys and girls of the superior, normal, and subnormal intelligence groups used in the experiment. The general indications are that girls are superior to the boys in learning the hardest exercises of both batteries, except in the subnormal groups in which the girls are inferior to the boys. The results of the experiment show the following definite positive conclusions:

1. There is no difference in the five easy exercises before or

TABLE IV

CORRELATIONS BETWEEN BOYS AND GIRLS IN THE FIVE EASY AND FIVE HARD EXERCISES OF THE POP BATTERY, BEFORE AND AFTER TRAINING, AND THE ELEVEN EASY AND ELEVEN HARD EXERCISES OF THE POP BATTERY, AFTER TRAINING, FOR THE AVERAGE TOTAL NUMBER OF PASSES FOR THE EXPERIMENTAL AND SAMPLE GROUPS

		POP-1		POP-2		POP-2	
		5 EE	*5 HE*	*5 EE*	*5 HE*	*11 EE*	*11 HE*
Group I Superior	Boys N-20 Girls N-20	0	0	0	1*	2*	10*
Group II Normal	Boys N-20 Girls N-20	0	4	0	2	4*	6*
Group III Sub-normal	Boys N-14 Girls N-11	0	5	0	2	3	0**
Group IV Sample	Boys N-6 Girls N-6	0	0	3	0	0	4*

* Indicates the relationship in inverse order.

** In Group III, neither sex did any of the exercises in the eleven hard group.

after training in the simple preliminary battery which changes to a slight indication favoring the girls in the eleven easy exercises after training in the difficult final battery.

2. The boys are superior to the girls in the five hard exercises of the simple preliminary battery before training which decreases to chance after training and favors the girls with significant yields in the eleven hard exercises of the final battery after training.

3. The girls are significantly superior in the difficult exercises of the difficult final battery, the significance of which may be attributed to intelligence and training.

4. The results of the sample group confirm those of the experimental groups and this fact increases the significance of the conclusions.

In Table V are presented the final graded orders of difficulty for the initial and end tests of the POP (preliminary objective performance) battery for boys and girls arranged according to the total number of exercises passed. The order for total population is a combination of the orders of boys and girls, in which the cross leg stand is the only exercise out of order when the two orders of difficulty, before and after training, are compared. As indicated by the consistency of this relative position, the orders may be accepted as reliable. The three difficult exercises which remained constant in all groups, before and after training, are the spider walk, pirouette, and foot jump. The snap-to-stand and the backward roll fluctuated

TABLE V

FINAL GRADED ORDER OF DIFFICULTY OF INITIAL AND END TESTS OF POP BATTERY FOR EXPERIMENTAL GROUPS ARRANGED FROM EASIEST TO HARD BASED UPON THE TOTAL NUMBER OF PASSES FOR BOYS AND GIRLS AND TOTAL POPULATION

POP-1 Initial Test (Before Training)

Boys N-54		*Girls* N-51		*Total population* N-105	
5 Easy Exercises:	*Total Passes*		*Total Passes*		*Total Passes*
Duck walk	44	Duck walk	48	Duck walk	92
Crab walk	36	Crab walk	29	Crab walk	65
Cross-leg stand	27	Cross-leg stand	24	Cross-leg stand	51
Knee jump	27	Knee jump	24	Knee jump	51
Forward roll	23	Spider walk	22	Forward roll	41
5 Hard Exercises:					
Snap-to-stand	22	Forward roll	18	Snap-to-stand	39
Spider walk	16	Snap-to-stand	17	Spider walk	38
Backward roll	11	Backward roll	7	Backward roll	18
Pirouette	10	Pirouette	5	Pirouette	15
Foot jump	10	Foot jump	1	Foot jump	11

POP-2 End Test (After Training)

Boys N-54		*Girls* N-51		*Total population* N-105	
5 Easy Exercises:	*Total Passes*		*Total Passes*		*Total Passes*
Duck walk	49	Duck walk	49	Duck walk	98
Crab walk	47	Knee jump	41	Crab walk	87
Forward roll	418	Crab walk	40	Knee jump	78
Knee jump	37	Forward roll	34	Forward roll	75
Cross-leg stand	34	Cross-leg stand	34	Cross-leg stand	68
5 Hard Exercises:					
Snap-to-stand	31	Snap-to-stand	30	Snap-to-stand	61
Backward roll	27	Spider walk	27	Spider walk	52
Spider walk	25	Pirouette	25	Backward roll	49
Pirouette	44	Backward roll	22	Pirouette	15
Foot jump	12	Foot jump	7	Foot jump	19

from easy to hard. The five exercises mentioned are the five hard exercises in the final order of difficulty for total population, before and after training.

An important observation in this table is the relative improvement from POP-1 tests to the POP-2 tests which is important to school teachers using these exercises as part of their class content. In all but three exercises which are the walks, two of which are the

easiest and only one in the group of five hard, the girls show a greater improvement than the boys.

Table VI shows the final graded order of difficulty for the end test of the FOP (final objective performance) battery for boys and girls arranged according to the total number of exercises passed. The order for the total population is a combination of the orders for the boys and girls. Arranged in decreasing difficulty, the back somersault, back hand spring, hand walk, hand stand, front somersault, and elbow lever are six exercises of the twenty-two used in the FOP battery which are too difficult for fifth- and sixth-grade boys and girls. The time and effort necessary to learn these exercises is too great in proportion to the number of subjects who learned them and should be excluded from class content. However, these exercises are advisable for outside class activity such as gym teams, tumbling

TABLE VI

FINAL GRADED ORDER OF DIFFICULTY OF END TEST FOP BATTERY FOR EXPERIMENTAL GROUPS ARRANGED FROM EASIEST TO HARD BASED UPON THE TOTAL NUMBER OF PASSES FOR BOYS AND GIRLS AND TOTAL POPULATION

FOP-2 End Test (After Training)

Boys N-54		*Girls* N-51		*Total Population* N-105	
11 Easy Exercises:	*Total Passes*		*Total Passes*		*Total Passes*
Neck dive	48	Cartwheel	40	Neck dive	83
Long dive	46	Neck dive	35	Long dive	73
Squat stand	39	Squat stand	34	Squat stand	73
Head stand	38	Head stand	34	Cartwheel	72
Cartwheel	32	High dive	30	Head stand	72
High dive	30	Round-off	28	High dive	60
Round-off	22	Long dive	27	Round-off	50
Hand spring	12	Front bender	23	Hand spring	31
Elbow stand	7	Hand spring	19	Elbow stand	23
Bucking broncho	6	Head spring	18	Front bender	26
Neck spring	6	Back bender	17	Head spring	22
11 Hard Exercises:					
Forearm stand	5	Elbow stand	16	Back bender	20
Snap-up	5	Bucking broncho	13	Bucking broncho	19
Head spring	4	Forearm stand	12	Neck spring	17
Elbow lever	4	Neck spring	11	Forearm stand	17
Front bender	3	Snap-up	7	Snap-up	12
Back bender	3	Elbow lever	5	Elbow lever	9
Front somersault	2	Front somersault	3	Front somersault	5
Hand walk	2	Hand stand	3	Hand stand	3
Hand stand	0	Back hand spring	1	Hand walk	2
Back hand spring	0	Hand walk	0	Back hand spring	1
Back somersault	0	Back somersault	0	Back somersault	0

squads, circuses, and in vaudeville, and the time utilized in their learning would then be justified on the basis of having extracurricular value. Besides these six, the neck spring, snap-up, and forearm stand remained constant as difficult exercises for all groups. The hand spring, head spring, front bender, and back bender fluctuated from easy to hard between groups and sex.

In general, the girls excelled in the performance of the more difficult exercises. One should also note that the difference in order of difficulty between boys and girls is small. When these differences are compared with the order of d fficulty of the combined groups of boys and girls, it may be noted that the difference decreases. The exercises in which the girls showed most improvement are those involving coordination, balance, and agility (head spring, elbow stand, and front bender). Contrary to the findings of several studies reviewed, girls in this study showed a greater degree of skill in performing the harder exercises requiring strength and endurance (forearm stand and bucking broncho) than did the boys. In the elbow lever, which is especially a strength exercise, although the difference is small, the girls also hold an advantage.

(5) *Does ability in a battery of simple skills enable one to learn a battery of more diff cult skills more easily, and do these batteries have predictive value?*

TABLE VII

PREDICTIVE CORRELATIONS BETWEEN INITIAL AND END TESTS OF POP BATTERY AND END TESTS OF FOP BATTERY BASED ON TOTAL NUMBER OF EXERCISES PASSED BY BOYS AND GIRLS FOR THE EXPERIMENTAL AND SAMPLE GROUPS

	Group I Superior		*Group II Normal*		*Group III Sub-normal*		*Group IV Sample*	
	Boys N-20	*Girls* N-20	*Boys* N-20	*Girls* N-20	*Boys* N-14	*Girls* N-11	*Boys* N-6	*Girls* N-6
POP-1—								
POP-2—11*	3*		23*	26*	5*	6*	14*	5*
POP-2—								
FOP-2—62	5		0	3	62	3	14*	13
POP-1—								
FOP-2—15	2*		15	0	9	6	0	0

* Indicates relationships in inverse order.

the experimental groups, and for the boys and girls of the sample groups. The correlations are for the purpose of prediction and are based upon the total number of exercises passed.

Table VII shows the correlations between the initial and end tests of the POP (preliminary objective performance) battery and

the end test of the FOP (final objective performance) battery for the boys and girls of superior, normal, and subnormal intelligence of the experimental groups, and for the boys and girls of the sample groups. The correlations are for the purpose of prediction and are based upon the total number of exercises passed.

The tests have a decidedly high positive predictive value, and all indications are that I. Q. and fundamental muscular skill ability are relatively constant. The conclusions drawn from the results of the experiment which suggest the predictive value of the two batteries of tests used in this study are:

1. There is about the same predictive efficiency for boys and girls.
2. Prediction is greater and more reliable in the higher levels of intelligence.
3. There is a definite significant positive degree of prediction in the progression from the criterion, the initial test of the preliminary battery, to the end test of the preliminary battery, to the end test of the final battery.

The general conclusion is that the ability to do the simple skills enables one to do the more difficult skills more easily, and the tests used in the batteries of this study have predictive value.

SUMMARY OF CONCLUSIONS

Specific conclusions.—The results of this study on the relation of intelligence to the learning of fundamental muscular skills show positive conclusions. The group comparisons show a significant degree of learning by the superior groups over the normal and subnormal groups marked superiority of the normal groups over the subnormal groups, and a high degree of superiority of the superior groups over the subnormal groups. The results of the sample groups confirm those of the experimental groups.

General conclusions.—The general conclusions drawn from the evidence presented in the preceding discussion, as collected from the subjects studied in this experiment and as analyzed through the three avenues of comparison, are as follows: a definite and positive relationship exists between various degrees of intelligence of fifth- and sixth-grade boys and girls and the learning of fundamental muscular skills, and this relationship can be measured.

A Study of Kinesthesis in Relation to Selected Movements

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INTRODUCTION

ALTHOUGH there is general agreement among physical educators that kinesthesis is part of the innate qualities contributing to motor educability and motor skills, there have been very few studies made in this field by the physical educator. Phillips[13]* found that there was a low but definitely positive relationship between kinesthesis and successful performance in the early stages of learning perceptuo-motor skills. He also states that there seems to be no basis for the phrase "general kinesthetic sensitivity and control."

Psychologists agree that kinesthesis is a factor in motor performance. That efficient kinesthesis is essential to the skillful performance of definite manual tasks has been shown by experiment.[5] Studies using maze patterns show that visual guidance is more effective in learning maze patterns than manual guidance,[6, 7] and that kinesthesis is unnecessary in learning to reproduce the maze pattern, but that it is essential to an acquisition of smooth flowing movements.[2]

STATEMENT OF THE PROBLEM

The purpose of this paper is to study kinesthesis in relation to selected movements commonly used in gymnastic and sport activities. Because there have been so few studies in this field this study is primarily of an exploratory nature. Two problems arise from this study: the first one which presents itself is that of devising tests which may measure kinesthesis; the second is that of the relation of kinesthesis to general motor ability.

For the purpose of this study, kinesthesis has been defined as the cognizance of bodily position and movements, i. e., the sense of muscular effort.

PROCEDURE

The subjects used for this study were a group of thirty-seven women students majoring in physical education at the University of Iowa. They were chosen at random from the freshman, sophomore, junior, senior, and graduate classes.

* Superior figures refer to numbered bibliography at end of article.

These thirty-seven subjects were given nineteen tests of kinesthesis** which, with the exception of the tests of balance and weight differentiation, were devised especially for this study. The tests included arm and leg movements, throwing, kicking, hitting, grip, balance, and weight differentiation. This last test was later eliminated because it did not discriminate sufficiently among subjects.

The administration of the tests took approximately forty-five minutes for each individual. During all the tests the subject was blindfolded so as to eliminate the effects of vision. Of the nineteen test items, seven were explained verbally to the subjects, six were explained and demonstrated, and in six items, stick-figure drawings were used in place of the demonstration to illustrate the position that the subject was asked to assume.

The first ten items were designed to measure the ability of the subject to reproduce arm and leg positions which had been explained or demonstrated by means of stick-figure drawings. These positions were considered in terms of the angle formed and were measured by specially constructed adjustable charts. The charts were divided by one degree lines radiating from a central point. The measurements of the angle formed were taken to the nearest degree and this degree constituted the record for the subject on each test.

In tests eleven through fourteen, which included throwing and kicking, similar adjustable targets were constructed. These targets were marked off into four concentric circles and divided into four equal sections; upper, lower, right, and left quarters. In these tests the score recorded was the section of the target touched by the subject's hand, toe, or the ball.

In Item 15, which was a test of striking ability, the paddle which was used to hit the ball was marked off into numbered squares. The score recorded was the number of the square where the ball was hit. The remainder of the tests needed no charts for measurements.

The performance scores were translated into "total deviation" scores which were used as the raw data for statistical analysis by means of product-moment correlations.[3]

Certain tests were combined as combination criteria and correlated with all eighteen tests. Intercorrelations were computed where needed for multiple correlations or where it seemed logical to expect some direct relationship.

In an attempt to find some answer to the problem of what relationship exists between kinesthesis and general motor ability, the General Motor Ability scores[14] of thirty-one of the subjects were correlated with the eighteen tests of kinesthesis and with the criteria.

** See Appendix for description of tests.

It did not seem feasible to determine reliability coefficients on these test items, as there are practice and memory effects which would alter conditions for a second administration. The scores were analyzed for the degree of consistency for each individual throughout the series of tests. Reliability correlations were done on odd-even halves of those tests having more than one trial.

ANALYSIS OF DATA

The results of the statistical analysis of data are shown by Table I. From a study of these findings certain facts evolve.

1. The intercorrelations of the various items show low and in some instances essentially zero correlation coefficients. However, in most cases, the coefficients are positive. Also, all correlations which are significant are positive.

2. The highest coefficient (.791) was between Items 1 and 2 in which the subject was asked to raise the arms sidewards, horizontally, and then forward horizontally. This high relationship was not unexpected because of the similarity of the tests.

3. The test items on actual throwing showed negative or nearly zero correlations with the five test items concerned with arm movements. This was also true of the test of hitting.

4. Three of the five items concerned with leg movements (Items 6, 7, and 10) show statistically significant correlations[12] with the test item of kicking.

5. The total score criterion shows significantly high correlations with the items on arm raising sideward 90° and arm raising forward 90°, both individually and in combination. Significantly high correlations with the total score criteron were also found with the knee bend 45°, leg raising from side lying to 20°, the dynamometer test, and the two balance tests.

6. When correlating the items of kinesthesis with the General Motor Ability scores the only items which had a correlation coefficient that was at all significant were those of balance and arms raising sideward 45°. The rest of the correlations were insignificant, with about as many negative as positive coefficients. The highest of the remainder was the dynamometer test.

7. When the total scores of the eighteen tests were correlated with the two G.M.A. scores, correlation coefficients of .192 and .248 were obtained, which would seem to indicate a low but positive relationship between kinesthesis and motor ability, as measured by the test of G.M.A. used in this study.

Combinations of items by multiple correlation were made to be used as criteria including (1) the total score, which, though not infallible, may be assumed to offer some measure of kinesthesis, as it is based on the combination of scores of tests set up to measure

TABLE I

CORRELATIONS AMONG THE TEST ITEMS

		1	2	3	4	5	6	7	8	9
1.	Arms side 90°									
2.	Arms forward 90°	.791								
3.	Arms side 130°	.275	.260							
4.	Arms side 45°	.233								
5.	Arms forward 45°	−.128								
6.	Hip bend forward 90°	.100								
7.	Knee bend 90°	−.183								
8.	Knee bend 45°	−.187						.312		
9.	On back—leg raise 60°	.035								
10.	On side—leg raise 20°	.321	.378				.507			
11.	Overarm throw—point	.181								
12.	Underarm throw—point	.157	.092				.288			
13.	Actual throw at target	−.296	−.305	.039	−.043	.076	−.100	.013	.103	−.003
14.	Kick at target	−.131	−.021	−.114	−.183	−.228	.491	.305	.178	−.170
15.	Hitting ball	.198	.170	−.003	−.104	−.170	.247	−.288	−.194	−.299
16.	Dynamometer	.153							.080	
17.	Balance—crosswise	.252			−.255		−.041			
18.	Balance—lengthwise	.061							.040	
19.	Combination of 1 and 2					−.764			.047	
20.	Combination 13, 14, and 15	−.120	−.111	−.171	−.001	−.158	.334	.189	−.088	−.210
21.	Obstacle race*			−.070		.098	−.178	−.386		.084
22.	G. M. $A._1$ (4 items)	.068	.081	−.033	−.400	.113	.203	−.199	−.088	−.181
23.	G. M. $A._3$ (3 items)			.105	−.162		3.14	−.243		−.170
24.	Total of 18 items	.869	.580	.159	.290	.214	.271	.274	.423	−.101

* Taken from G. M. A. battery.

kinesthesis as defined by this study; (2) the two G.M.A. scores which, according to Scott,[14] give a measure of motor ability with a relatively high degree of validity; and (3) the combination score of the tests on throwing, kicking, and hitting which were believed to be representative of movements most commonly used in sport activities. These criteria were chosen arbitrarily because there is no available standard measure of kinesthesis against which the test items could be correlated. Of these three, the total score criterion was thought to be the most adequate as a measure of general kinesthesis.

It was hoped that a small battery would be found that could be substituted for the whole test of 18 items, and which might be used as a basis for further studies in this field. It was also hoped that a battery could be found which would measure motor ability. The question of using specific skills to measure motor performance is a field in which much more research needs to be done.

Items were combined by multiple correlation if they had a relatively high correlation with the criterion (total of 18 test items) and relatively low intercorrelations. The results of these various

TABLE I (cont.)
CORRELATIONS AMONG THE TEST ITEMS

10	11	12	13	14	15	16	17	18	19	20	21	22	23
.369	.181												
−.124	.189	.115											
.472	.099	.504	−.121										
.345	−.061	.135	.005	.170									
.077			−.046	−.053	.275								
			−.148	−.149	.309	.203							
.055			−.092	.049	.156	.051	.402						
			−.317	−.086	.213		.208						
.345	.157	.437	.567	.606	.489	.074	−.093	.051	−.194				
	.366	.291	.048	.152	.031	.101	.155	−.025	.101	−.146			
−.010	.161	−.131	−.172	−.129	.078	.286	.428	.298	−.065	−.190			
			−.117	−.070	.210	.286	.408	.240	.121	−.055			
.563	.115	.078	−.096	.037	.224	.403	.400	.412	.581	.048	.081	.192	.248

multiple correlations are shown in Table II. It will be seen that the three tests, arms side 90°, lying on side with leg raising 20°, and balance lengthwise, when correlated with the total score, give a coefficient of .984 which would seem to indicate that these tests could be substituted for the total test and give relatively the same results.

TABLE II

COMBINATION OF ITEMS BY MULTIPLE CORRELATION

Combinations	*Total of all 18 Items*	*Total of Items 13, 14 & 15*	G.M.A.$_1$	G.M.A.$_2$
Items 1, 10	.919			
Items 1, 10, 18	.984			
Items 10, 6, 12		.501		
Items 6, 12		.489		
Items 10, 12		.464		
Items 6, 10		.391		
Items 4, 17			.522	
Items 6, 17				.525

Items one through ten were analyzed for the consistency with which each individual assumed positions which were greater or less

than the angle desired. Thirty-two of the subjects, in more than fifty per cent of the total trials, showed angle measurements which were greater than the angle desired; four subjects showed angle measurements less than the angle in more than fifty per cent of the trials; while one individual showed as many angle measurements greater that the desired angles as less. There was also found to be a generally high percentage of consistency between successive trials of the items on throwing, kicking, and hitting (Items 11, 12, 13, 14, and 15.)

The reliability of those items having more than two trials was computed by comparing the sum of the odd-numbered trials with that of the even ones. These coefficients, stepped up by the Spearman-Brown formula according to actual length of the test, appear in Table III.

TABLE III

RELIABILITY CORRELATIONS
ODD-EVEN HALVES

Test Items	*r for alternate halves*	*Spearman-Brown r*
Balance—crosswise (Item 17)	.57	.73
Balance—lengthwise (Item 18)	.64	.78
Actual Throw (Item 13)	.63	.78
Dynamometer (Item 16)	.86	.93
Kick (Item 14)	.66	.80

In an analysis of the effect that the type of explanation used in the first ten test items had on the response made by the subject, it was found that there was less deviation from the "perfect" score in those items which had only oral explanation. These results probably should not be too literally interpreted because Items 1, 2, 6, and 7 concern positions which are much more familiar to the average individual than the various positions illustrated by the stick-figure drawings. It is probably due more to the unfamiliarity and the difficulty of the positions that caused the large variance from the "perfect" score, than the difference in type of explanation.

CONCLUSIONS

In view of the facts derived from an analysis of the data collected for this study the following conclusions can be drawn.

1. The total score criterion gave significant correlations with seven different test items including arm and leg positions, the dynamometer test, and one of the balance tests. When arms raising sideward 90° and leg raising 20° were combined a coefficient of .919 was obtained. By adding the second balance test to this battery the coefficient was raised to .984, which seems to indicate that this combination of three items could be substituted for the total score criterion.

2. The sports criterion showed significant correlations with the following tests: hip bend 90°, leg raising 20°, underarm point, actual throw, kick, and hitting ball. By combining the hip bend 90°, leg raising 20°, and underarm point a correlation coefficient of .501 was obtained.

3. The actual throw at the target gave a negative or nearly zero correlation with the five items concerned with arm positions. Similar negative or near zero correlations were found between hitting the ball and the five arm positions.

4. In the light of the correlation coefficients obtained, it would seem that there is no real relationship between the test of kinesthesis, as set up for this study, and the general motor ability, as measured by the particular G.M.A. batteries used.

5. The intercorrelations between test items were in general low, but more than half of them were positive. All significant correlation coefficients were also positive.

6. The results of this study have fallen somewhat short of the purpose as stated in the beginning. This failure to achieve the desired results may be assumed to be due primarily to the limitations of available criteria for measuring kinesthesis. Some indication is given, however, of the relationship between certain types of tests and the type of test that might profitably be used for further study. As this was primarily an exploratory study the results were not expected to be too conclusive. It is hoped that further studies will be made in the field of kinesthesis and its relation to motor ability and motor learning.

APPENDIX

Description of Test Items

The subjects were blindfolded throughout the test so as to eliminate the effects of vision.

Item 1: Arms side—90°. The subject was asked to stand with her back to the chart (same chart used for Items 1 through 5) with the center point of the chart in line with the axis of the right shoulder. She was then asked to raise her right arm sideward to horizontal, with the palm facing forward. A metal pointer (used in tests 1 through 5) had previously been taped to the back of the subject's wrist at a mid point between ulna and radius. The angle of the arm position was determined by locating the nearest degree line to the end of the pointer. This degree was recorded, and the deviation from the angle desired, found later. The subject was then asked to move to the right so that the center point of the chart was in line with the axis of the left shoulder. The same performance was then repeated with the left arm, and the degree measured and recorded.

Item 2: Arms forward—90°. The subject was placed with her right side to the chart, with the center point of the chart aligned with the axis of the right shoulder, and instructed to raise both arms forward to horizontal with palms facing each other. The degree of the angle formed was recorded.

Item 3: Arms side—130°. The subject was asked to stand as in Test 1, and was then shown a stick-figure drawing with arms raised sideward to 130° (the degree of the angles was not mentioned to the subject and not written on any of the stick-figure drawings) and asked to assume the position which she saw, first with her right arm and then the left. She was blindfolded after she was shown the drawing and before assuming the position. The degree of the angles of both right and left arms were recorded separately.

Item 4: Arms side—45°. The subject was asked to stand with her back to the chart, as in Item 1, and was then shown a stick-figure drawing in which the arms were raised sideward to a 45° angle. She was asked to assume this position first with her right arm and then with her left arm, as described in Items 1 and 3. The degree was recorded separately for each arm.

Item 5: Arms forward—145°. The subject was asked to stand with her right side to the chart as in Item 2. She was shown a stick figure drawing in which the arms were raised forward to a 145° angle, and then asked to raise both arms forward to the position which she had just seen. The angle was recorded for both arms.

Item 6: Hip bend—90°. The subject was instructed to stand with her right side to a chart (same chart used in Items 6 through 8 and identical to the chart used in Items 1 through 5, differing only in size). The central point of the chart was aligned with the subject's right hip joint. The subject was then asked to raise her right leg forward so that the upper leg was parallel to the floor, the right knee bent slightly. The same performance was then repeated with the left side to the chart and the left leg being bent. The metal pointer had been attached to the epicondiles of the femur. The angle was recorded for each leg.

Item 7: Knee bend—90°. The subject was instructed to stand with the right side to the chart and the chart was adjusted so that the mid-point of the angles was in line with the axis of the knee. The subject was then asked to bend the right leg backwards from the knee so that the lower leg was parallel to the floor. The same procedure was used with the left leg, the left side being toward the chart. Both degrees were recorded. The pointers were attached to the outer malleoli.

Item 8: Knee bend—45°. With the chart adjusted as for Item 7 and with her right side to the chart the subject was shown a stick-figure drawing with the leg bent at the knee to a 45° angle. The subject was asked to assume this position first with the right leg and then with the left leg. The degree for each leg was recorded.

Item 9: On back, leg raise—60°. The subject was instructed to lie down on her back with her right side to the chart (same chart used in Items 9 and 10), which was adjusted so that the center of the angles was at the axis of the hip. The subject was then shown a stick-figure drawing in which the leg was raised at a 60° angle, and asked to assume this position with first her right leg, and then with her left leg with her left side to the chart. The metal pointer was attached to the outer malleoli.

Item 10: On side, leg raise—20°. The subject was instructed to lie on her left side with her back to the chart and the central point was adjusted so as to be in line with the axis of the right hip. She was then shown a stick-figure drawing with the leg raised to a 20° angle and asked to raise her right leg to this position. The procedure was repeated with the subject on her right side and the left leg was raised. The degree was recorded for each leg.

Item 11: Overarm throw—point. The subject was shown a target which was adjusted so that when her right arm was raised forward to horizontal her

finger touched the center of the target. She was then asked to take three practice over-arm throwing motions at the target making the effort to touch the center of the target with her fingers on the follow-through. She was allowed to assume any position in front of the target which was most comfortable to her. The subject was then blindfolded and given two trials with the right hand. She was then given several practice trials in the same manner with the left hand, blindfolded and given two test trials with the left hand. The scores for each trial were recorded; the scores being determined by the area of the target which the subject touched with her fingers on the follow-through.

Item 12: Underarm throw—point. The same procedure was followed as in Item 11, except that the movement was underarm. The target was lowered slightly so that the follow-through was an easy natural one, about waist high. Two trials were given for both right and left arms with practice trials for each arm. The scores for all trials were recorded as in Item 11.

Item 13: Actual throw at target. The subject was given a tennis ball and told to stand behind a line drawn on the floor 12 feet from a target (same type as used in Items 11 and 12, except with a 33-inch diameter instead of 16). The target was hung on the wall with the center 48 inches from the floor. The subject was asked to take three practice throws at the target. She was allowed to use either right or left arm, whichever she preferred. She was then blindfolded and given two trials. The ball was powdered so that it left a white mark where it hit the target. Scores were recorded for both trials as in Items 11 and 12.

Item 14: Kick at target. The subject was asked to stand about eighteen inches in front of and facing a target which was adjusted so that the center was eight to fourteen inches from the floor (same target as used in Items 11 and 12). The target height and distance of the subject from the target were adjusted to each individual. The subject was then asked to bend the right leg at the knee and let the leg swing easily forward in a kicking motion, allowing the toe to stop when it touched the center of the target. She was given three such trials, trying to hit the center of the target with her toe on each trial, and then was blindfolded and given two trials each with right and left foot (no additional practice trials were given for the left foot). The scores for each trial for each foot were recorded, the score being the spot where the subject's toe touched the target on each trial.

Item 15: Hitting ball. The subject was given a paddle marked off into numbered spaces and was instructed to stand with the paddle extended at about waist height. A small practice cotton golf ball was then adjusted so that it hung suspended at the level of the center of the paddle. The ball was suspended by a string which was passed through the center of the ball, the other end was fastened to a small spring which was hung from the ceiling. The subject was given three practice trials and was told that the object was to hit the ball with the center of the paddle. She was then blindfolded and given two trials, the scores of both trials were recorded, as determined by the space on the paddle where the ball was contacted. As in Item 13 the subject was allowed to use whichever hand she preferred. Both sides of the paddle were marked and after the first trial the paddle was turned in the subject's hand so that she would hit the ball with the other side of the paddle on her second trial. The ball was lightly covered with powder so that a mark was left on the paddle where it came in contact with the ball.

Item 16: Dynamometer. The subject was given a hand dynamometer, with the dial uppermost so that it could be seen readily, and instructed to

grip it until the needle registered 10 and again until it registered 20. She was given three trials with her right hand to get the "feel" of the amount of strength necessary for each of the two grips. She was then blindfolded and asked to reproduce these grip strengths as called out by the administrator in the following order: 10, 20, 20, 10, 10. Between each grip the needle was returned to zero and the grip strength registered by the needle recorded. The same process was followed using the left hand, with the order in which the grip strengths were called out to the subject altered to: 20, 10, 10, 20, 20.

Item 17: Balance - Crosswise. The subject was instructed to place the ball of her right foot crosswise on a balance stick (12"x1"x1") which was placed on the floor, raise her left foot from the floor and see how long she could thus maintain her balance without touching her free foot or any other part of her body to the floor. She was given a preliminary trial and then blindfolded and given six consecutive trials. The seconds were counted out loud and the time recorded for each trial on the second when she lost her balance. This same procedure was repeated with the left foot, and the time for each of the six trials recorded.

Item 18[1]*:* Balance—lengthwise. The subject was instructed to place her right foot lengthwise on the balance stick, raise her left foot from the floor, and see how long she could maintain her balance without touching her free foot or any part of her body to the floor. The same procedure for timing and scoring was used as in Item 17, recording each of the six trials for each foot.

Item 19[8, 15]: Weighted boxes. Five weighted boxes, ranging in weight from 3 grams to 15 grams, were scattered out on the table in front of the subject and she was asked to arrange them according to their weight, from light to heavy. Because this last test failed to discriminate sufficiently between subjects it was discarded and not used in any of the analyses of data.

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National Survey of Teacher Loads in Departments of Physical Education in Institutions of Higher Education

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PROCEDURE

In an attempt to determine the procedures in practice and if possible the thoughts of leaders in the field of education, relative to the teacher-loads of members of the staff of men's departments of physical and health education in institutions of higher education, a series of questionnaires was sent throughout the country. On the basis of the findings, it is hoped that standards may be established.

A total of 117 questionnaires was sent to the heads of departments of physical and health education. Replies were received from fifty-one, and the results have been tabulated.

Another questionnaire was sent to the federal and state commissioners of education, as well as to the state directors of physical education. Replies were received from sixteen of the state and federal officials.

A third questionnaire was sent to the registrars of 115 colleges and universities. Only nine replied, and their reports have been herein summarized.

In addition to the three groups referred to above, questionnaires were also sent to educational associations (such as the Russell Sage Foundation, Carnegie Foundation, etc.), educational publications (such as *Journal of Higher Education, Phi Delta Kappa,* etc.), and to educational research bureaus (such as University of Illinois, Columbia University, Ohio State University, etc.). Replies were received from twenty of them, but could not be utilized in the study, as the remarks were too general, fitting a local situation, claiming no information, or time of receipt.

The listing of the educational leaders, associations, publications, and schools, was obtained from the publications of the U. S. Office of Education, The College Physical Education Association, The American Association for Health, Physical Education, and Recreation, and similar organizations. In all, a total of 323 questionnaires was sent out and 96 replies received.

The writer was chairman of a departmental committee that inaugurated the study, consisting of Dr. E. V. Ferguson, and Messrs. J. L. Mendelis, A. Richards, and H. G. Smith.

Accompanying the questionnaire, was a letter indicating that the sanction of the American Association for Health, Physical Education, and Recreation and that of the College Physical Education Association had been secured.

SUMMARY OF REPLIES TO QUESTIONNAIRES

The reports received have been tabulated and placed into one of three groups. They are:

Group I—Physical Educators.—This refers to reports received from the heads of departments of physical and health education in institutions of higher education. (Fifty-one replies.)

Group II—State and Federal.—This group includes the federal and state commissioners of education, as well as the state directors of physical education. (Sixteen replies.)

Group III—Registrars.—This group has reference to the registrars of institutions of higher education. (Nine replies.)

It is interesting to note that 35 states, plus the District of Columbia are included in the cooperating institutions, giving a wide geographical distribution.

The items included on the questionnaires, where possible, are grouped to indicate the consensus of opinion from each of the three groups referred to above.

STAFF AND STUDENT LOADS

Table I is a tabulation of student enrollment and teaching loads. It reveals that the teaching load for physical education is approximately five hours above that of the academic load. However, the consensus of the heads of departments is twenty to fifteen in favor of reducing the load to that of the academic staff, which shows an average of approximately fifteen hours per week. The non-physical education groups lean slightly in the other direction, which may tend to indicate a reason for present practice.

FUNCTIONAL WEIGHT CLASSIFICATION

In addition to securing information as to present practices, opinions as to the relative weights of the various functions within a department of health and physical education were also secured.

The functions listed in Table II were set up and preceded by the following statement:

> On the assumption that 15 hours per week is the "normal academic" teaching load, and that each hour of teaching calls for two additional hours of preparation per week, then the total weighted hours would be equivalent to 15 times 3, or a total of forty-five weighted hours per week.

On this "theoretical" basis, assign weights of relative importance to each of the following possible assignments in a Department of Health and Physical Education, in an institution of higher education.

TABLE I

TABULATION OF REPLIES PERTAINING TO STAFF AND STUDENT LOADS

	*Group I**	*Group II**	*Group III**	TOTALS
1. Male enrollment of the College				
a. Present			529(6) **	
b. Pre-war			2055(6)	
2 Male enrollment "required" physical education				
a. Present	532.8(44)			
b. Pre-war	1799.3(42)			
3. What do you consider the normal average teaching load, for members of the teaching staff?		16.1(14)		
4. Average teaching load for academic staff				
a. Present			15.3(9)	
b. Pre-war			14.5(6)	
5. Average teaching load for physical education staff				
a. Present	20.6(41)			
b. Pre-war	21.1(37)			
6. Number of members on the physical education staff				
a. Present	6.7(40)			
b. Pre-war	9.8(40)			
7. Do you feel that the average teaching load of the physical education staff should be the same as the academic staff?				
a. Yes	(20)	(4)	(3)	(27)
b. No	(15)	(7)	(4)	(26)

* Group I means physical educators, Group II means state and federal, Group III means registrars.

** Number in parentheses indicates number answering question.

TABLE II

FUNCTIONAL WEIGHT CLASSIFICATION

	*Group I**	*Group II*	*Group III*	TOTALS
1. Typical classroom lecture (Weight of "3" was assumed as basis)	3.0	3.0	3.0	3.0
2. Repeat lecture (same to two classes)	2.2(37)**	1.9(13)	2.4(9)	2.2(59)
3. If a weight other than "3" is given in answer to item 2 (above), is such distinction also made in the "academic" subjects:				

a. Yes	(16)	(10)	(6)	(32)
b. No	(3)	(2)	(2)	(7)
4. Instruction in "required" physical education				
a. In charge of gym class	2.1(36)	2.5(12)	2.2(9)	2.2(57)
b. Assisting in gym class	2.0(36)	1.9(11)	1.8(9)	1.9(56)
c. In charge of pool class	2.1(36)	2.4(12)	2.3(9)	2.2(57)
d. Assisting in pool class	1.6(35)	1.9(10)	1.9(9)	1.7(54)
e. Class clerical duties	0.9(26)	1.3(9)	1.1(7)	1.0(42)
5. Coaching				
a. Major sports—head coach	2.7(29)	3.0(11)	2.6(8)	2.8(48)
b. Minor sports—head coach	2.5(28)	2.6(11)	2.6(8)	2.6(47)
c. Major sports—asst. coach	2.1(29)	2.5(10)	2.6(8)	2.3(47)
d. Minor sports—asst. coach	1.9(29)	2.4(9)	2.5(8)	2.1(46)
e. Travel time	0.9(24)	1.1(6)	1.1(7)	1.0(37)
f. Sports clinic	2.0(25)	2.6(8)	2.0(6)	2.1(39)
g. Game time	2.1(27)	2.1(6)	1.7(7)	2.0(40)
6. Director of athletics	2.2(21)	2.3(7)	2.6(5)	2.3(33)
7. Student conferences	1.2(28)	2.0(12)	1.4(6)	1.5(46)
8. Staff meetings	1.3(30)	1.0(11)	1.4(6)	1.3(47)
9. Pre- and post-term scholastic and medical exams	1.5(25)	1.4(11)	1.8(6)	1.5(42)
10. National and sectional professional meetings	1.1(28)	1.2(9)	1.8(6)	1.2(43)
11. Departmental research	1.8(25)	1.6(9)	2.3(6)	1.9(40)
12. Departmental committees	1.4(26)	1.1(9)	1.4(6)	1.4(41)
13. Departmental reports	1.3(26)	1.0(9)	1.3(6)	1.3(41)
14. Courses in School of Education	2.7(24)	2.9(11)	2.3(7)	2.7(42)
15. Intramurals				
a. In charge	2.1(28)	2.7(11)	1.9(7)	2.2(46)
b. Assistant	1.6(27)	2.2(10)	1.9(7)	1.7(44)
16. Recreation	1.5(25)	2.3(10)	1.3(6)	1.7(41)
17. Medical staff				
a. Examinations	2.1(21)	2.3(6)	2.5(6)	2.2(33)
b. Return conferences	1.8(21)	1.8(6)	2.3(6)	1.9(33)
c. First aid	1.6(21)	1.3(6)	2.3(6)	1.7(33)
18. Administration	2.0(25)	2.3(7)	2.2(7)	2.1(39)
19. Supervision	1.7(23)	2.7(6)	2.2(7)	2.0(36)

* Group I means physical educators, Group II means state and federal, Group III means registrars.

** Number in parentheses indicates number answering question.

SUMMARY

Table II indicates the functional weight classification as determined by the replies received from fifty-one physical educators (Group I), sixteen federal and state officials (Group II), and from nine college registrars. In addition to the three groups referred to, the results of all the groups as a unit are also shown.

On the basis of a value of three for a typical classroom academic lecture period, the duties performed by a physical education department range in value from 2.8 down to 1.0 as indicated by the total groups.

The required physical education program has a value of 2.2 for the instructor in charge of a class with slightly lower indices for those assisting. A credit of 1.0 is allowed for clerical work in connection with the class program.

The duties of a coach are indicated to have a value of 2.8 down to that of 1.0 for travel time. The unit of value for coaching is higher than that alloted for the required program.

The results shown in Table II further indicate that credit allowance in the teaching program should be alloted for such items as student conferences (1.5), staff meetings (1.3), pre- and post-term duties (1.5), professional meetings (1.2), research (1.9), departmental committees (1.4), and reports (1.3).

Courses taught in a School of Education have a high rating of 2.7 and the handling of recreational programs, a value of 1.7, which is equal in value to the value given to the staff member assisting in an intramural program, while the person in charge is given 2.2 as a weight value.

The duties of administration and supervision show values of 2.1 and 2.0 respectively. (Note: Reples to survey by administrators.)

CONCLUSIONS

On the basis of the findings as indicated in the summary, an instructor with the responsibility of teaching in the required program would be required to teach twenty hours for a value equivalent to that given a teacher of academic subjects.

Example:	*Weight*		*Hrs. Per Week*		*Total*
Academic	3	x	15	=	45
Physical Education	2.2	x	20	=	44

It must be realized, however, that items such as class clerical duties, student conferences, pre- and post-term duties, etc., have not been included in the sample tabulation. If they are to be included in the duties of the staff member then logically the number of teaching hours in equivalent value, should be reduced.

Perhaps the physical educators who had replied in the affirmative (shown in Table I) to the question of whether or not they felt that the average teaching load of the physical education staff should be the same as the academic staff are on the right track.

RECOMMENDATIONS

Perhaps standardization of recommendations for teaching loads in physical education based on such surveys as this one will aid in justifying the placing of physical education teaching loads on a basis equivalent to that of academic teaching.

Studies Completed By Members of the National Association of Physical Education for College Women, 1943-1945

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THE following list of studies has been compiled from reports made in the spring of 1945 by representatives of all institutions having membership in the National Association of Physical Education for College Women. Bibliographical data are included for those which have been published. Unpublished theses are in most cases available from the several college libraries by means of inter-library loan. Further information regarding other unpublished studies may be obtained from the sponsoring department, either from the author or from the department library.

The studies are listed (1) in alphabetical order, by author, and numbered, and (2) according to content, by number. Many of the studies are listed under several content subdivisions.

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SUBJECT MATTER INDEX

Motor Fitness Tests For High School Girls

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THE PROBLEM

THIS study develops two motor fitness screen tests for high school girls (1) a single-period test of six items, and (2) a double-period test of twelve items. Nine of the twelve items used in this test are scaled, as well as three others not in the test,[1] to permit graduated scoring on separate items. The total test scores are also normed and standards for screening out approximately the lower fifth of the pupils on the basis of total scores are derived. Suggestions are given for administering the tests.

Due to the increased emphasis on physical fitness during World War II, the demand has increased for short, reliable, and valid ways of screening the relatively unfit girls from those relatively more fit in motor fitness. The need is for tests which differentiate poor motor control and endurance from average and superior ability in fundamental characteristics of balance, flexibility, ag lity, strength, power, and endurance, using practical stunts which can be eas ly and quickly administered indoors or outdoors with very little equipment.

The motor fitness tests presented do not purport to measure the refined skill ability of the pupils in specific activities, but rather to measure the gross abilities necessary to everyday living in the general handling of the body. In this study, the fundamental body movements are divided into six specific aspects of emphasis. *Balance,* involving the ability to feel kinesthetically, is vital to walking, bicycling, danc ng, swimming, and countless daily activities. *Flexibility* permits ease of movement necessary to bending, stretching, twisting, and body suppleness of graceful movement. *Agility,* as the capacity for quick, efficient control of the body, is important to most sport skills and important to the safety of the individual in emergencies where quick reaction is necessary. *Strength* is the capacity of the body as a whole to exert great force and is essential to such

This article is based on a master's thesis in the School of Physical Education, University of Illinois, by Mary O'Connor, supervised by Dr. T. K. Cureton.

[1]The Kneeling Jump and Dizziness Recovery were "Pass" or "Fail" tests which did permit continuous scoring. The Foot and Toe Balance was not scaled because the data were not kept beyond 10 seconds.

activities as lifting, carrying, pushing, and climbing. *Power,* as the quality that makes it possible to move the body weight with a maximum of effort, connotes an explosive action. It is necessary in athletic activities of high school girls, in dance activities with leaping, jumping, and sudden muscle contractions. *Endurance* is the capacity for continuous exertion. Various types of endurance are included, such as, muscular endurance and cardiovascular endurance.

EXPERIMENTAL PROCEDURE

The construction of a suitable motor fitness test presented a problem due to the lack of specific information about the motor ability of high school girls. Various tests were tried in informal experimentation in an attempt to reduce the number of possible items to an administrable size. The fundamental assumption is that the selection of items by expert judgment is sufficiently accurate to include within the preliminary battery most of the items of significant value. A tentative form of nineteen items was made from the preliminary testing, and standards were set as a result of observation of performance in the experimental testing. Some of these were revised when the data were gathered on a much larger number of girls.

The Data.—The test items were administered to 660 high school girls in physical education classes in Pekin Community High School,

TABLE I

RELIABILITY COEFFICIENTS FOR MOTOR FITNESS TEST ITEMS

Range	*Test Item*	r_{11}	N
	Standing Broad Jump	.98	40
	Dizziness Recovery	.98	40
	Hurdle Sit	.98	50
	Vertical Jump	.98	40
.90-.98	Kneeling Jump	.97	40
(Excellent)	Stick Body	.96	30
	Sit-Ups	.96	30
	Baske ball Throw, Sitting	.96	40
	Hops	.96	30
	Squat Thrust (Burpee) 30 secs.	.95	30
	Brouha Step Test	.94	30
	Kneeling Push-ups	.94	30
	Illinois Agility Run	.92	40
	Trunk Flexion	.91	50
	Trunk Extension	.90	50
.80-.89 (Good)	Squat Thrust (Burpee) 10 secs.	.85	40
.70-.79 (Fair)	Foot and Toe Balance	.70	35
.60-.69	Run-in-Place—Breath Holding	.67	30
(Poor)	Stork Stand	.61	35

Pekin, Illinois, and in Oak Park and River Forest Township High School, Oak Park, Illinois. The data thus obtained became the basis for the major part of the test construction.

Norming Procedure.—In the norming of the data the means and standard deviations were obtained. Using the formula: Standard Score $= 6\sigma/100$, normative tables were constructed for twelve items from which actual scores were obtained and which yielded normal distribution curves. The items scored dichotomously did not permit the use of this technique. The distributions are reasonably normal for all items and also for the total scores.

Reliability of Items.—To determine the reliability of the test items, the items were given twice to a group of thirty to fifty students* under as nearly the same conditions as possible. The second trial was given on a separate day and there was no practice on specific items or in specific areas during the intervening period. The scores for both trials were correlated to obtain the reliability coefficients. These are shown in Table I.

Validity of Items.—In determining the validity, the composite score of the items was selected as the criterion, as any one item seemed to measure too narrow an area to adequately represent motor fitness. A recognizable limitation is found in that the item will be correlating with itself to a certain extent, and the validity coefficients will be a little higher than the true relationship. The use of this total score criterion has been defended by Smith.[2] In the final tests the items are not proportionately weighted as to their contribution to the whole criterion but this is an acceptable practice when eight or more items are used. The validity coefficients are used to select the relatively more valid items and to eliminate those which have very poor all-round predictive value.

The correlation of an item with the total criterion is not a complete or rigid statistical evaluation. It is justifiable only when preliminary experimentation with a large number of possible items leads to a selection, on *a priori* grounds, of the most valuable items. A better validation might be obtained if a more adequate independent criterion existed, or a competent jury to decide the relative importance of the items. Since no rigorous theory of motor fitness exists, the authors hold that the composite criterion is the best available under the circumstances and advance the test as exceedingly practical after considerable experimentation. Further research should show how the total test scores correlate with teachers' judgments, with other physical fitness tests, and with the results of longer and more complete

*The number varied on different test items.

[2]Max Smith. *The Relationship Between Item Validity and Test Validity.* New York: Bureau of Publications, Teachers College, Columbia University, Contributions to Education, No. 621, 1934, p. 35.

TABLE II

VALIDITY COEFFICIENTS FOR MOTOR FITNESS TEST ITEMS ARRANGED ACCORDING TO RANK OF ITEMS

*Area of Emphasis***	*Name of Item*	*Validity Coefficient*	*Rank*
Endurance	Hops	.648	1
Endurance and Agility	30-sec. Squat Thrust	.616	2
Strength	Push-Ups	.583	3
Strength	Sit-Ups	.577	4
Endurance	Brouha Step Test	.513	5
Balance*	Dizziness Recovery	.503	6
Agility*	Kneeling Jump	.495	7
Endurance	Breath Holding	.483	8
Agility	10-sec. Squat Thrust	.481	9
Agility	Agility Run	.465	10
Power	Basketball Throw	.443	11
Flexibility	Trunk Extension	.424	12
Balance*	Foot and Toe Balance	.422	13
Flexibility	Trunk Flexion	.415	14
Balance*	Stork Stand	.410	15
Power	Standing Broad Jump	.396	16
Flexibility*	Hurdle Sit	.339	17
Strength*	Stick Body	.307	18
Power*	Vertical Jump	.0595	19

*Validity coefficients obtained by biserial technique using formula:

$$r_{bis} = \frac{M_s - M_t}{\sigma} \sqrt{pq}$$

Wherein:

M_s=Mean of the portion of the sample averaging higher
M_t=Mean of the portion of the sample averaging lower
σ=standard deviation of the whole group
p=proportion passing the standard
q=proportion failing the standard

The composite standard score including all items was used as the criterion. "Pass" or "Fail" on each item was correlated with this criterion.

**These areas of emphasis are logically derived and named. They are not justified in the factor analysis sense in this study but a companion study shows agreement with similar material: Darrell E. Latham, *Factor Analysis of the Illinois Motor Fitness Screen Test*, Urbana: University of Illinois, master's thesis, 1945. Pp. 85. In Latham's study a factor analysis was made to determine the validity of the six fundamental areas of emphasis. The factor analysis showed six factors named balance, flexibility, agility, strength, power, and endurance, which corroborated the original logic. A simpler grouping did not seem possible with original logic. A simpler grouping did not seem possible with this material (p. 71). The factor analysis solution was no better than the shorter and simpler statistical method used in the article, "A Short Screen Test for Predicting Motor Fitness," *Research Quarterly*, May 1945, pp. 106-119.

factor analysis solutions. The case for these two batteries rests upon the assumption that the areas of emphasis named are logically the most important for all-round motor fitness and that the items chosen

for standardization are valid representations of the trait emphases named. Latham's factor analysis on identical material validates the assumption of the six areas of emphasis, namely, balance, flexibility, agility, strength, power, and endurance.

ORGANIZATION OF THE SCREEN TESTS

Two types of screen tests were organized from the study to meet the needs of various situations. A short motor fitness screen test that could be given in one forty-minute period is proposed for use when time allotment is very limited. A longer form of the test that would take two forty-minute periods to administer is advisable as it permits a more adequate measurement of the individuals due to the inclusion of more items in the battery which makes the form more valid. These tests are designed to screen out the lower third and therefore the greatest differentiation will be found at the lowest levels of performance. The normative standard score scale is the basis for the standard on each item, using the score of thirty-five. The criteria for selecting the items to be included in the batteries were: (1) validity, (2) reliability, (3) relative difficulty, and (4) classification under the six categories of emphasis. Validity is concerned with the predictive value of a given test item in appraising the all-round motor fitness of the subject; if the item does not possess demonstrable validity it does not accomplish this purpose. Reliability refers to the consistency of measurements of the given abilities. If the measurements of a subject show considerable variability when the test is repeated under the same conditions with no intervening practice period, the measurements are not reliable. The relative difficulty of the items is important in the selection of items. If a very high per cent pass a given test item, or a very high per cent fail the given item, it indicates that the item must be changed in some way to be of value. If an item is too difficult for all but a very few, there will be little differentiation, and the same follows if the item is so easy that almost all pass it. Classification of the items in the six categories is important to these tests. Several items in the same

TABLE III

SELECTION OF ITEMS FOR MOTOR FITNESS SCREEN TEST
(Single Period Test)

Area of Emphasis	*Item*	*Reliability Coefficient*	*Validity Coefficient*	*Relative Difficulty Rank*
Balance	1. Dizziness Recovery	.98	.503	1
Flexibility	2. Trunk Extension	.90	.424	2
Agility	3. Kneeling Jump	.97	.495	1
Strength	4. Kneeling Push-Ups	.94	.583	2
Power	5. Basketball Throw	.96	.443	2
Endurance	6. 30-Sec. Squat Thrust	.95	.616	2

category may have higher validities than items in other categories, but rather than duplicate in the same area, one best item from each area has been chosen for the motor fitness battery rather than too much duplication from one aspect of emphasis. With the double-period test battery, the two most valid items in each category have been selected.

To minimize the limitation of condensing the test to a pattern in which only one item for each area of emphasis is given, the choice of items is largely determined by the validity coefficients. The one exception to the choice of items with the highest validity coefficients is found in the inclusion of the Squat Thrust. The Hop gave a slightly higher coefficient but it is not economical of time, which is important to this form of the test.

TABLE IV

SELECTION OF ITEMS FOR MOTOR FITNESS SCREEN TEST
(Double Period Tests)

Area of Emphasis	*Item*	*Reliability Coefficient*	*Validity Coefficient*	*Relative Difficulty Rank*
Balance	1. Foot and Toe Balance	.70	.422	2
	2. Dizziness Recovery	.98	.503	1
Flexibility	3. Trunk Extension	.90	.424	2
	4. Trunk Flexion	.91	.415	3
Agility	5. Kneeling Jump	.97	.495	1
	6. Illinois Agility Run	.92	.465	3
Strength	7. Sit-Ups	.96	.577	1
	8. Kneeling Push-Ups	.94	.583	2
Power	9. Basketball Throw	.96	.443	2
	10. Standing Broad Jump	.98	.396	3
Endurance	11. 30-Sec. Squat Thrust	.95	.616	2
	12. Brouha Step Test	.94	.513	3

The reliability and validity coefficients of the items chosen are good. The validity coefficient for the item Foot and Toe Balance is rather low, but informal testing after the data were gathered indicates that the reliability would be raised considerably if the best of three trials was recorded instead of the first trial as was done in the experimental work. It serves as an easy item to give a better normal distribution to the total scores.

NORMS FOR TOTAL TEST SCORES

Norms for the total test scores have been derived since the revision of the original test. The single-period test was given to fifty girls in Chrisman Township High School, Chrisman, Illinois, and a standard score scale constructed from the data. There is a decided limitation in such a small sampling but it is believed of value until further data are obtained. The double-period test was given to the girls in Chrisman High School and also to 423 girls in Streator High School, Streator, Illinois, making a total of 473 high school girls

to whom the test was given. Since the standard is set to screen out approximately the lowest fifth of a given high school group, the standard is set at the standard score of thirty-five* and there is little differentiation in the upper levels. This is a recognized limitation of screen tests. It will be noted that the longer form gives a more adequate measurement of the individuals.

SUMMARY AND CONCLUSIONS

The motor fitness tests presented provide a classification technique that is economical of time and equipment and adaptable to a given situation, and the batteries are made up of items of demonstrated reliability and validity. The standard set at the standard score of 35 screens out the lower third of the high school group but does not differentiate at the higher levels of performance and is therefore limited in scope. The twelve-item test is advised if time permits, rather than the six-item test, as the reliability and validity of the total scores tends to increase with the inclusion of more items.

The significance of the technique of lengthening the amount of time allowed for a given test item to increase the value of the item is demonstrated in the Burpee Squat Thrust. In the test batteries the item is included twice. The reliability coefficient for the ten-second exercise is .85 and the validity coefficient is .481. In comparison, the reliability coefficient for the thirty-second exercise is .95, and the validity coefficient is .616.

Using the total score criterion, good validity was found for most of the items in the experimental test. The highest validity coefficients were obtained for the items involving the areas of strength and endurance, indicating that these areas are of considerable importance in determining all-around motor fitness. Low validity was noted for some items, Hurdle Sit (.339) and Stick Body (.307), but it is recognized that they have some positive relationship to the criterion and it is possible that the validity might be raised with some slight change in the test items. Vertical Jump (.059) showed such a slight relationship to the criterion it was considered of negligible value in the test battery. Ninety-five per cent of the students passed the item indicating that the standard was too low to show significant difference in ability.

The most unreliable test items used in the experiment were found to be Foot and Toe Balance (.70), Run-in-Place-Breath Holding (.67), and Stork Stand (.61). Informal experimentation seems to indicate that the reliability coefficients could be raised with a change in the administration of the items, a change in the standard set, or in the test itself.

*This is equivalent to 18.40 per cent of a normally distributed group.

RECOMMENDATIONS

Further research should include application of the testing batteries to various high school situations to give additional insight into the motor fitness of high school girls. Research to determine the improvements in motor fitness after various types of programs, i.e., dancing, swimming, gymnastics, etc.

Sampling did not permit study of the difference between prepubescent (P_1) and post-pubescent (P_2) girls; further research should determine any difference in standards for these groups.

More research should determine the physiological limitations of girls. Research should also determine whether the superiority of boys in motor fitness tests represents a difference in capacity of potential ability, as distinguished from differences brought about by past experiences and opportunity for practice.

MOTOR FITNESS SCREEN TEST FOR HIGH SCHOOL GIRLS
(SINGLE-PERIOD TEST)

Area of Emphasis	*Item*	*Minimum Standard to Pass*	*Pass*	*Fail*
Balance	1. Dizziness Recovery	5 revolutions around finger, count 5, walk straight line 5 feet.	.....	.....
Flexibility	2. Trunk Extension	Prone lying position. Hands behind neck. Feet held. Raise chest, clearing 15″ from chin to floor.	.....	.....
Agility	3. Kneeling Jump	Kneeling, ankles extended, spring to standing position and hold balance for 3 secs. Allow 2 trials.	.....	.....
Strength	4. Kneeling Push-Ups	Weight on hands and knees, back straight. Touch chest to floor and push up to original position. Back must be straight and abdomen must not touch floor. Do 9 times continuously.	.....	.....
Power	5. Basketball Throw	Sitting, feet 18″ apart. Double overhand throw starting with ball over head. Throw at least 16′.	.....	.....
Endurance	6. Burpee Squat Thrust (30 secs.)	Start standing (1) squat, hands on floor, (2) legs straight backwards, weight on hands and toes, (3) squat, (4) stand erect. Repeat 11¾ times in 30 secs.	____	____
		TOTAL SCORE.....	.....	

RECOMMENDATIONS .....

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Top, Running in Place—Breath Holding; center, Standing Broad Jump and Basketball Throw (sitting); left and below, Burpee Agility Test.

MOTOR FITNESS SCREEN TEST FOR HIGH SCHOOL GIRLS
(Double-Period Test)

Area of Emphasis	*Items*	*Minimum Standards to Pass*	*Pass*	*Fail*
Balance	1. Foot and Toe Balance	Stand on either foot, hands on hips, other foot 6" off ground. Hold 10 secs., rise to toe. 10 secs. 3 trials.	.....	.....
	2. Dizziness Recovery	5 revolutions around finger, count 5, walk straight line 5 feet.	.....	.....
Flexibility	3. Trunk Extension	Prone lying postion, hands behind neck, feet held, raise chest, clearing 15" from chin to floor. 3 trials.	.....	.....
	4. Trunk Flexion	Sitting, feet 18" apart, hands behind neck, knees held to floor, bend forward so distance from forehead to floor is 11" or less. 3 trials.	.....	.....
Agility	5. Kneeling Jump	Kneeling, ankles extended. Spring to standing position and hold balance for 3 secs. Allow 2 trials.	.....	.....
	6. Illinois Agility Run	Prone position, sprint to 30' line, reverse, zig-zag around chairs and back, sprint to 30' line, reverse and sprint across finish line. 24 secs.	.....	.....
Strength	7. Sit-Ups	Sitting, feet held 18" apart, hands behind neck. Lower trunk backwards, touch left elbow to floor, sit up and cross to touch left elbow to right knee. Reverse. Do 8 times continuously.	.....	.....
	8. Kneeling Push-Ups	Weight on hands and knees, back straight. Touch chest to floor and push up to original position. Back straight, abdomen off floor. Do 9 times continuously.	.....	.....
Power	9. Basketball Throw	Sitting, feet 18" apart. Double overhand throw starting with ball overhead. Throw at least 16'. 3 trials.	.....	.....

	10. Standing Broad Jump	Standing on mat at starting line. Jump forward from both feet to a landing on both feet. Measure distance from starting line to heel print. Fall backwards fails trial. 3 trials to do 55 ins.	.....	.....
Endurance	11. Burpee Squat Thrust (30 secs.)	Start standing. (1) squat, hand on floor, (2) legs straight backwards, weight on hands and toes, (3) jump to squat, (4) stand erect. Do 11¾ times in 30 secs.	.....	.....
	12. Brouha Step Test	Step up 18" left, step up right (both feet on platform), step down left, step down right. Repeat 30 times per min. for 4 min. Pulse count 1 min., 2 min. and 3 min. after exercise for 30 secs. each. Score: Duration of exercise in secs. x 100 divided by 2 x sum of pulse counts.	.....	.....
		TOTAL SCORE.....		.....

RECOMMENDATIONS .....

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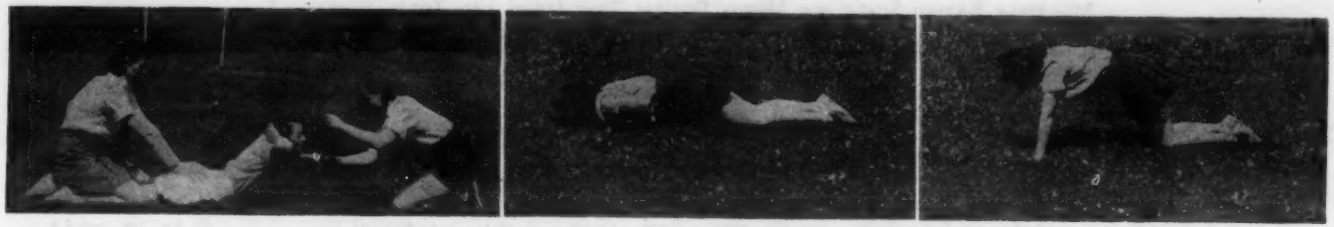
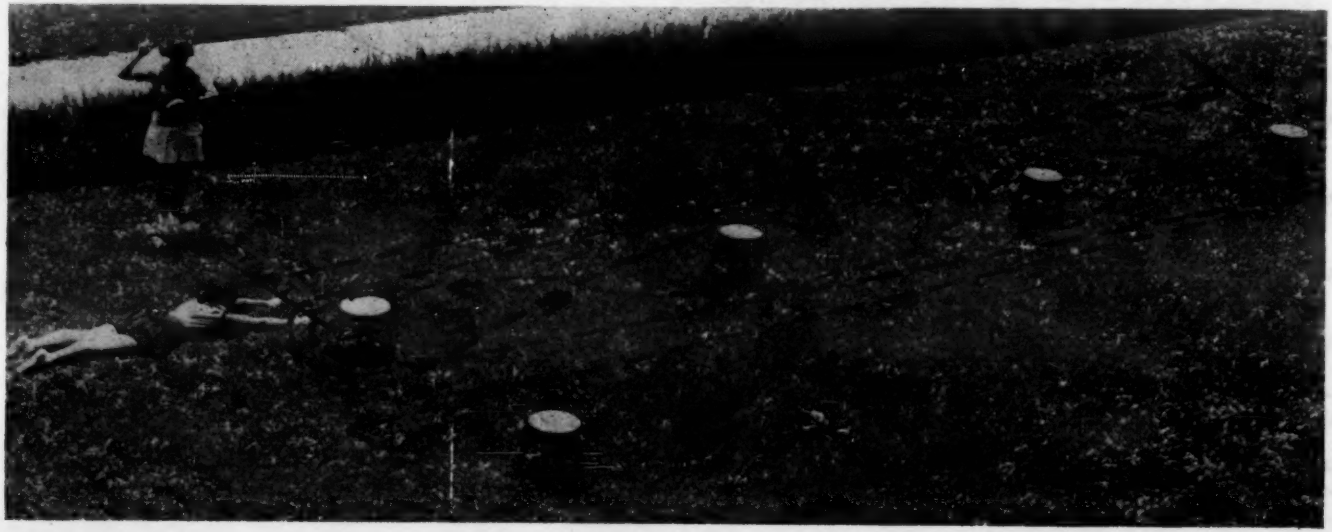


Left, Trunk Extension; center and right, Push-ups (kneeling).



Illinois Agility Run.

PROFILE ANALYSIS SHEET

Multiple Rating Scale for Motor Fitness Test Items and Total Scores

Classification	Trunk Extension Ins.	Trunk Flexion Ins.	Burpee Squat Thrust Number (10 secs.)	Illinois Agility Run. Secs.	Sit-Ups (feet held) Number	Push Ups (kneeling) Number	Standing Broad Jump Ins.	Basketball Throw (sitting) Ft.	Run-in-Place (60 secs.) and Breath Holding Secs.	Burpee Squat Thrust Number (30 secs.)	Hops Number	Brouha Step Test Score	Total Score, 6-items	Total Score, 12-items	Letter Grade	Standard Score	T-Score	Percentile
	29	—1	7¾	16	30	38	80	27	31	18¼	509	94			A+	100	80	99.87
Excellent	28	0	7½	16.5	28	36	78	26	30	17¾	487	91				95	77	99.65
	27	1	7¼	17	26	33	75	25	28	17¼	465	87				90	74	99.18
	26	2	7	17.5	25	31	74	24	27	16¾	443	83				85	71	98.2
Very Good	25	3	6¾	18	23	29	72	23	25	16¼	421	80	6	12	A	80	68	96.4
	24	4	6½	19	21	27	70	22½	24	15¾	400	76				75	65	93.3
	22	5	6¼	19.5	20	24	68	22	22	15¼	377	72				70	62	88.4
Above Average	21	6	6	20	18	22	66	21	20	14¾	355	69	5	11	B	65	59	81.6
(Good)	20	6½	5¾	21	16	20	64	20	19	14¼	333	65				60	56	72.6
	19	7	5½	21.5	14	18	62	19½	17	13¾	311	62				55	53	61.8
Average	18	8	5¼	22	13	16	60	19	16	13¼	289	58	4	10	C+	50	50	50.0
	17	9	5	22.5	11	13	58	18	14	12¾	267	54				45	47	38.2
	16	10	4¾	23.5	9	11	57	17	12	12¼	245	51				40	44	27.4
Below Average	15	11	4½	24	8	9	55	16	11	11¾	223	47	3	9	C	35	41	18.4
(Fair)	14	12	4¼	24.5	6	7	53	15	9	11¼	201	43				30	38	11.5
	13	13	4	25	4	4	51	14	8	10¾	179	39				25	35	6.7
Poor	12	13¼	3¾	26	3	3	49	13½	6	10¼	157	36	2	8	D	20	32	3.6
	10	14	3½	26.5	2	2	47	13	5	9¾	135	33				15	29	1.8
	9	15	3¼	27			45	12	3	9¼	113	30		7		10	26	.82
Very Poor	7	16	3	28	1	1	43	11	1	8¾	91	25	1	6	F	5	23	.35
	5	17	2¾	28.5	0	0	41	10	0	8¼	69	22		5		0	20	.14
Mean	18.06	8.27	5.23	22.23	12.70	15.57	60.42	18.80	15.65	13.30	289	57.90						
Standard Deviation	3.68	2.92	.81	2.16	5.88	7.44	6.48	2.42	5.31	1.60	73.20	12.10						

Research Abstracts

Prepared by the

NATIONAL COUNCIL OF THE RESEARCH SECTION

ANATOMY, BIOLOGY, and ZOOLOGY

Hammond, Warner Smith, and Joseph C. Hinsey. "The Diameters of the Nerve Fibers in Normal and Regeneration Nerves." *Jr. Comp Neur.*, 83: 1. (August, 1945.)

In the recovery which follows section and suture, large myelinated nerve fibers tend to regain their diameters if they regenerate into a distal segment containing fiber pathways of equal diameter. Regenerating fibers may be restricted in size if the distal segment contains fiber sheaths appreciably smaller in diameter.—*Wistar Institute.*

Hochberg, Melvin, Daniel Meinick, and Bernard L. Oser. "Physiological Availability of the Vitamins." *Jr. Nutrition*, 30; No. 3. (September, 1945.)

In vitro tests emphasized, the rapidity with which the ascorbic acid oxidase in vegetables can oxidize ascorbic acid to and beyond the dehydroascorbic stage is described. Simple incubation of the dietary mixture at body temperature for a period of 6 hours resulted in a loss of approximately 60% of the biologically active vitamin. The amount of enzyme present in the homogenized diet was sufficient to catalyze oxidation of added ascorbic acid beyond the dehydroascorbic acid stage. The results of the human availability study indicated that no greater destruction of either the naturally occurring ascorbic acid or the extra ascorbic acid ingested took place in vivo prior to absorption. Apparently ascorbic acid oxidase is destroyed or its activity is inhibited in the gastrointestinal tract. Oxidation of the vitamin to dehydroascorbic acid may have occurred but in view of the biological activity of this partially oxidized form of the vitamin, this is of no importance nutritionally.—*The Wistar Institute.*

Reynold, Earle L. "The Bony Pelvic Girdle In Early Infancy. A Roentgenometric study." *Am. Jr. Anthrop.* N. S., 3: 4.

A roentgenometric study was made of the human bony pelvis from birth through 12 months. Measurements were taken on tracings of 467 serial roentgenograms of 95 infants. Problems: (1) growth patterns and relationships; (2) sex differences; (3) relations of pelvic structure to body size and shape, skeletal, and tooth development, age of walking; and (4) hereditary aspects. Principal conclusions: (a) rate of pelvic growth is fastest between birth and three months, progressively decreases to 1 year; (b) variability is highest at birth; (c) certain birth and 1-year measurements are significantly associated; (d) boy's measurements are more highly intercorrelated at birth; (e) girl's measurements are more variable; (f) significant sex differences are found in the pelvic height, ilium breadth, ischioiliac space, bi-ischial breadth, pubis length, breadth of sciatic notch, relative inlet breadth, anterior segment index; (g) boys tend to lead in outer measurements, girls in inner measurements; (h) no significant associations are found between pelvis shape and body-build or time of walking; (i) a significant positive association is found between breadth of newborn and mother's inlet, but not in depth or index; (j) siblings suggestively, but not significantly, more similar than non-siblings.—*The Wistar Institute.*

Santiana, Antonio. "Blood Groups In the Indians of Ecuador: Preliminary Communication." *Am. Jr. Phys. Anthrop.*, N. S., 3: 3.

The Ecuadorian Indians whose blood groups are here reported are divided into two geographically separate series: (1) a highland or "serrania" series consisting of 5,817 subjects; and (2) upper Amazon series consisting of 944 subjects. The former is divided into five regions: Imbabura, Chimborazo, Cotopaxi, Tungurahua and Pichina. The main sereological differences between these two series is the complete lack of AB in the Amazon series, together with the smaller percentage of A and a correspondingly higher percentage of 0. The combined series show the following: 95.22% group 0; 3.56%, A; 1.0%, B, ant 0.21% of AB. Data for each group are given separately.—*The Wistar Institute.*

Stone, Leon S., and Frederick S. Ellison. "Return of Vision in Eyes Exchanged Between Adult Salamanders of Different Species." *Jr. Exp. Zool.* 100: 2.

In eighty experiments eyes were exchanged and normally oriented between adults of two entirely different species of salamanders, Amblystoma punctatum and Triturus viridescens. The Triturus grafts degenerated but the Amblystoma eyes on Triturus hosts followed a course of recovery as they do in homoplastic transplantations, retinal degenerations being followed by complete regeneration. The new optic nerve connected all functional quadrants of the Amblystoma retina with the proper central areas in the optic tectum of the Triturus brain; for normal visuomotor responses were obtained in eight cases which were tested 3 months after operation. Visual acuity appeared higher than in normal Amblystoma but lower than in normal Triturus.—*The Wistar Institute.*

EDUCATION

Alilunas, Leo J. "Neened Research in Teacher Mental Hygiene." *Jr. Educ. Res.*, 38:9.

Educational research has now become occupied with the problem of the effect of personality of the teacher on the development of children. The mental hygiene of the teacher as a subject itself remains a neglected area.

Few effective studies of teacher personality and maladjustment have been undertaken. Many more studies are needed before significant conclusions can be formed to the extent and nature of teacher mental illness.

There is little evidence that real progress has been made in mental hygiene programs by teacher-training institutions since 1932. Colleges and universities attract better students than do teachers' colleges and normal schools. Apparently talented youth is not drawn into teaching. Teacher-training institutions have gone all out in selling students on teaching regardless of aptitude and desirable personality traits.—*Foster J. Flint.*

Lorge, Irving. "Schooling Makes a Difference." *Teachers College Record*, 46:8.

In 1921-22 approximately 863 boys in the 8B classes of public elementary schools in New York City were given a series of tests of abstract intelligence, mechanical adroitness, and clerical ability. In May, 1941, the same 863 people were sent letters asking them to submit to retesting. One hundred and thirty-one men agreed. The correlation between the 1921-22 abstract intelligence score and the score on the Thorndike test taken in 1941 was .62. With the Otis the correlation was .64. The multiple correlation between the 1921-22 test of intelligence, the Otis, and the highest grade completed in school was .79.—*Carolyn Bookwalter.*

Martin W. Edgar. "Determination of the Principles of the Biological Sciences of Importance for General Education," *Science Education*, 29:3.

From a list of principles as found in a previous research of textbooks, a study was made to determine which of these principles were of importance to general education to permit understanding of scientific materials appearing in selected magazines and newspapers. Analyses were made of newspapers and magazines selected as to reliability of materials presented for human biology, animal biology, foods and nutrition, and plant biology. The 300 major principles and 236 minor principles had a total of 2,573 statements assigned to them for the one year of publication of the newspapers and magazines. The principles were then ranked and later evaluated by selected specialists and laymen. The highest ranking 100 principles are given.—*Carolyn Bookwalter.*

The Nation's Schools. "What About Expanded School Services?" School Opinion Poll, *Nation's Schools*, 36:2.

Questionnaires were mailed to 500 school administrators. Of these 18% responded by the closing time of the poll. Visual aids seem to be indicated to experience the first expansion with health teaching second. Vocational education ranked third and adult education ranked fourth. School community cooperation is predicted to expand recreation as well as medical and dental care. Many felt there would be no expansion in some states due to continued lack of money while in other states it would be due to lack of education of the public.—*Carolyn Bookwalter.*

The Nation's Schools. "What About Postwar School Financing?" School Opinion Poll, *Nation's Schools*, 36:1.

Of the 500 questionnaires sent to school administrators, 27% responses were received. From 26 to 39% of those responding felt that construction costs should be ⅓ to ½ given by the government and the remainder by local support. About one-half felt there should be 25% federal support with state and local support to fill the rest. Many want federal aid without federal control. There was an inclination toward a combination of capital reserve and borrowing (45%) and long-term borrowing (31%).—*Carolyn Bookwalter.*

HEALTH AND NUTRITION

Bricker, Mildred L., Harold H. Mitchell and Gladys M. Kinsman. "The Protein Requirement of Human Subjects." *Jr. Nutrition*, 30:4.

Fifty nitrogen balance studies were carried out upon nine women subjects to determine the requirements for different types of dietary protein. The test foods were milk, patent white flour, soy flour, a combination of soy and white flour, and a well balanced mixture of protein foods. All test foods provided 91% or more of the total nitrogen of the test diets and were cooked in an appropriate manner if they were ordinarily prepared by cooking. Each source of dietary nitrogen was studied at different levels of intake in order to define the relationship between intake and balance of nitrogen. This relationship was shown to be rectilinear and satisfactorily described by the equation of a straight line, the slope of which is the product of the true digestibility and the biological value of the dietary nitrogen. The biological values of dietary nitrogen obtained in this manner were: for milk 74, for white flour 41, for soy flour 65, for the soy-white flour 55, and for mixed foods 65. The amounts of nitrogen required for equilibrium, as ordinarily determined, were respectively, 2.76, 4.76, 2.88, 3.31, and 3.12 mg. per basal calorie. When due allowance is made for probable dermal losses of nitrogen and for the growth of tissues during adult life, the average daily protein requirements per 70 kg. body weight are: for milk 43 gm., for white flour 74 gm., for soy

flour 47 gm., for the soy-white flour combination 54 gm., and for the mixed foods 50 gm.—*The Wistar Institute.*

Evans, Robert J. and James L. St. John. "Estimation of the Relative Nutritive Value of Vegetable Proteins by Two Chemical Methods." *Jr. Nutrition*, 30:3.

A comparison was made between protein nutritive value (expressed as gain per unit of supplementary protein), and the chemical protein quality index using ten soybean oil meals, two cottonseed meals, and two cull pea meals. A comparison was also made between the protein nutritive value and the per cent of total nitrogen present as albumin, globulin, prolamine, glutelin, and residual protein. The chemical protein quality index appeared to give a good indication of the relative protein nutritive value of the vegetable protein concentrates studied with the exception of the overcooked soybean oil meals. A coefficient of correlation of .946 was obtained when three expeller process meals were not included. A correlation of .928 between the protein nutritive value and per cent glutelin was obtained for the heat treated concentrates. A determination of the per cent glutelin and residual protein appears to offer a method of determining the extent of heat denaturation of soybean proteins.—*The Wistar Institute.*

Holmes, Arthur D. and Carlton P. Jones. "Effect of Sunshine Upon the Ascorbic Acid and Riboflavin Content of Milk." *Jr. Nutrition*, 29:3.

The effect of sunshine upon the ascorbic acid and riboflavin of milk exposed in commercial one-half pint bottles has been measured with a pyrheliometer equipped with an automatic recording device. The milk was exposed for two 30- or two 60-minute periods. The "sunshine" varied from a total of 4.8 gm. cal. per sq. cm. on a rainy day to 144.6 gm. cal. per sq. cm. for a bright day. The temperature of the milk varied depending upon velocity of the wind, greenhouse effect of the milk bottles, and intensity of the sunshine. The reduced ascorbic acid disappeared rapidly, for little if any was present after 30 minutes' exposure. The riboflavin disappeared more slowly. There was a 10% loss during 60 minutes' exposure on a rainy day and about 85% loss during exposure to bright sunshine for 120 minutes. Destruction of riboflavin increased fairly consistently with the increase of sunshine intensity until 60 to 70% of the riboflavin was destroyed when the milk was exposed to a total of 50-70 gm. cal. per sq. cm. Increasing the sunshine from a total of 70 to 140 gm. cal. per sq. cm. caused a slow increase in the destruction of riboflavin. These data show that milk exposed on the consumer's doorstep to strong light or sunshine is likely to lose a large amount of ascorbic acid and riboflavin.—*The Wistar Institute.*

Hrubetz, Mary C., Harry J. Deuel, Bernard J. Hanley, and Martha Fairclough. "Studies of Carotenoid Metabolism." *Jr. Nutrition*, 29:4.

The administration of vitamin A in doses of 50,000 (group 3) or 200,000 I.U. (group 4) daily to women starting with the sixth month of pregnancy resulted in a marked increase in the vitamin A content of the milk during the subsequent lactation. In the early milk the average values of vitamin A per 100 ml. were as follows: group 1 (no extra vitamin A supplement), 331; group 2, 599; group 3, 869; group 4, 1047. The maximum value was 2,160 I. U. obtained for a sample in group 4. There was continued increase in vitamin A in supplemented groups for 6 months which was the duration of experiments although average values lowered somewhat. No alterations in other components were noted.—*The Wistar Institute.*

Slanetz, Charles A. and Albert Scharf. "Effect of Soybean Phosphatides on Vitamin A Metabolism." *Jr. Nutrition*, 30:4.

Further study of an unknown factor in soybean lecithin as previously reported has yielded additional information on its activity. Liver storage and blood levels of vitamin A in the rat have been investigated as influenced by specific factors, namely choline, soybean lecithin, heated lecithin, iodized lecithin, cholesterol, and iodine used as supplements in a purified basal diet containing synthetic B vitamins instead of yeast. Under the conditions of our experiments of all substances tested only commercial lecithin markedly influenced storage and blood levels of vitamin A in the rat. Iodine interfered with the effect while heating soybean lecithin interfered but little. The presence of an unknown factor in commercial soybean lecithin is indicated by these observations.—*The Wistar Institute.*

Watson, Ellen K., Elinor W. McGuire, Frieda L. Meyer, and Millicent L. Hathaway. "Calcium Metabolism of Pre-School Children." *Jr. Nutrition*, 30:4.

Calcium metabolism was studied in eight pre-school children for periods of 16 weeks. Four children were given 1,122 mg. calcium per day, and four only 775 mg. Five variations in the diet were used: basal diet alone, basal diet plus 100 mg. ascorbic acid, basal diet plus 3.38 gm. potassium citrate with and without the ascorbic supplement, and basal diet plus orange juice. Calcium retentions during the 16 weeks averaged 131±50 mg. on the higher level of intake, and 96±26 mg. on the lower level. None of the supplements significantly altered the retention of calcium in these eight children. Potassium citrate did lower the urinary calcium excretion significantly. In at least five of the eight subjects the absorption of calcium did not appear to be the main factor regulating its retention, and in all eight factors other than diet alone were responsible for its regulation.—*The Wistar Institute.*

PHYSIOLOGY AND EXPERIMENTAL PSYCHOLOGY

Birren, James E. "Static Equilibrium and Vestibular Function." *Jr. Exp. Psy.*, 35:2.

Observations of body-sway and railwalking tests were made on a nineteen-year-old male who had lost all nerve functions (vestibular) following an attack of acute meningococcus meningitis. The existence of the vestibular defect was established by complete absence of response to the caloric and Barany choir tests.

Postrotational nystagmus time and body-sway measurements were made on forty-five male subjects who were normal.

The findings of this study were interpreted as indicating that man may maintain stable posture despite loss of vestibular function and that measurements of body sway cannot be used to detect vestibular defects. Postural defects may occur following the loss of vestibular functions, but the defect is soon compensated for.—*Berthold Demsch.*

Fisher, M., James E. Birren and Alan L. Leggett. "Standardization of Two Tests of Equilibrium: The Railwalking Test and the Ataxiagraph." *Jr. Exp. Psy.*, 35:4.

The two tests described in this report are apparently quite different in the kinds of ability required for good performance. Both the zero correlation between ataxiagraph scores and railwalking scores and the difference in effect of practice on test scores are evidence that quite different sensorimotor functions are being measured.

Both test procedures in this paper appear suitable for inclusion in a group of tests to measure sensorimotor performance. Of the two tests the ataxiagraph yields the more reliable scores. The reliability of the railwalking tests cannot be regarded as entirely satisfactory for work with small populations. Improvement could be expected from doubling the test length.

No relation exists between railwalking and ataxiagraph scores; performance on the two tests, therefore, is presumed to depend on different factors.—*Berthold Demsch.*

Forbes, Gilbert. "The Effect of Certain Variables on Visual and Auditory Reaction Times." *Jr. Exp. Psy.*, 35:2.

The reaction times of one hundred seventy-eight male subjects, varying in age from seventeen to fifty-three, are recorded under different conditions. The recording instrument is the d'Arsonval clock, and the wiring of the equipment is designed so that either a visual or an auditory signal can be selected by the operator. The influence of certain variables on these reaction times is considered statistically.

Findings of the study seem to indicate that reaction times to light and sound are only partially dependent. The reaction time to sound tends to increase with age and with proximity to a meal, but is unaffected by practice or fatigue. The reaction time to light improves slightly with practice, and is unaffected by ordinary degrees of fatigue, by proximity to a meal, or by age. —*Berthold Demsch.*

Maxwell, U. S. and Glen Wakeham. "The Basal Metabolic Rate of the American Negro, With Particular Reference to the Effect of Menstruation on the Female." *Jr. Nutrition*, 29:4.

One hundred and eighty-four basal observations, using the Benedict-Roth-Collins apparatus were made on 27 negro college women from ages 17 to 35 years of age. The tests were divided into two groups; one consisted of a small number of subjects for which daily variations during menstrual cycle were determined: the other, in a larger group, had tests distributed over longer intervals. Additional information was also sought in reference to racial metabolism in 29 observations on 14 college men of varied activity. The observations were compared with the DuBois standards as modified by Boothby and Sandiford. The basal metabolic rates of the women and men were respectively −14.8 and −12.6% below the standards of reference used. A composite graph of all females showing basal metabolic variations is presented together with graphs of individual daily variations. The data confirm the reported effects of the menstrual cycle on basal metabolism. These consist essentially of a pre-menstrual rise in the basal metabolism with a lowering during the actual menstruation and in the immediately post-menstrual period.—*The Wistar Institute.*

Travis, Roland C. "An Experimental Analysis of Dynamic and Static Equilibrium." *Jr. Exp. Psy.*, 35:2.

This study is an experimental analysis of various behavorial aspects of postural balance and body orientation, including an analysis of individual and sex differences with respect to these traits. Some of the important problems considered can be treated as questions. (1) What effect does practice have on balancing skill? (2) What is the relative importance of the visual sense fields in postural balance? (3) Does exercise effect postural balancing skill? (4) What are the relationships between the physical measurements of weight, height, and distance from the center of gravity of the body to the standing base, length of feet, and balancing skill? (5) What are the relationships

between perceptive abilities and motor abilities in postural balance?

To determine the relationships between static and dynamic equilibrium and other motor skills involving primarily voluntary responses, steadiness of manual movement, eye-hand coordination, and simple reaction time were recorded.

The findings indicate that a small sex difference was found in favor of women in stabilometer performance with weight controlled. Mild exercise had little effect on dynamic stabilometer but increased body sway significantly due to increase in respiration which in turn increased the head movements. There was high correlation in balancing skill and in eye-manual coordination.—*Berthold Demsch.*

Index to Volume XVI (1945)

Cumulative Author, Subject Matter, and Title

Numbers refer to number of issue, first, and page number second. Number 1 is March; number 2, May; number 3, October; number 4, December. For example, 3:231 refers to March, page 231. No supplements to Volume XVI were published.

Editorial Policies

THE Editorial Committee has approved the following policies for the publication of material in the *Quarterly:*

1. Manuscripts should be sent to the Editor who will see that each one is read by at least two members of the Board of Associate Editors. The Editor will advise the author as to the suitability of the paper or the desirability for revision.

2. Papers are not judged by arbitrary standards of length but on their content of new research results in the field of physical education, health education, and recreation, presented with the greatest brevity compatible with scientific accuracy and clarity.

3. Since manuscripts will not be insured against loss or damage, authors are expected to retain duplicate copies of all material submitted.

4. An original typewritten copy of the manuscript should be submitted. The content should be double spaced with a margin of 1½ inches on each side.

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1 Katherine B. Crisp, *Health for You*, p. 520. (books)

2 Stern, Francis. *Applied Dietetics*. Baltimore: William and Wilkins Company, 1943. Pp. x plus 29. (books)

3 Corbin, H. D., "Current Problems in Recreation," *Journal of Health and Physical Education*, 15:6 (June, 1944), pp. 315-16, 353-54. (magazines)

4 Kraines, S. H., and E. S. Thetford. *Managing Your Mind*. New York: The Macmillan Company, 1944. Pp. viii plus 374.

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